

FACTORS INFLUENCING TRANSPORT BUYER'S CHOISE OF TRANSPORT SERVICE

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A EUROPEAN LITERATURE REVIEW

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ABSTRACT

The choice of transport service is a key issue in understanding the transport market and designing a competitive transport system. The customers' choice of transport service is based on a number of factors that are considered and weighted against each other. For a transport service provider, e.g. a forwarder or a haulier, it is of key importance to understand which factors are important to the customer.

Several studies have investigated the determining factors for the choice of a transport service. A review of the studies has been made in this research in order to compare and synthesize the previous findings on transport service choices. The review focuses on studies published in the English and Scandinavian languages after the year 1990. It includes studies on European conditions where the actual opinion of the transport customer has been studied through interviews and surveys, and does not include modelling approaches or analyses based on statistical data of the transport service choice. It is a fact that the knowledge about the transport service choice lies with the person making the decision. Although, studying the attitude of these people is often more challenging than other approaches, it is our opinion that these studies

come closest to revealing the reasons for the transport service choice. The review includes a short overview of the studies and the methods used.

The review finds that the important core factors in choosing transport services are cost, transport time, reliability and transport quality. After ensuring that the basic transport quality requirements are met (e.g. on-time deliveries, transport damages, transport times), most of the decisions are made based on price. However, the willingness to pay for lower environmental impact is low. Rail is perceived as being more environmental friendly, although several studies mention a negative attitude towards rail.

The literature survey covers 1990 to 2009 and includes a structured overview of the leading academic journals, academic reports and dissertations complemented by non peer-reviewed reports from the Scandinavian countries. Although there is a potential difference in research quality between peer-reviewed and non-peer reviewed reports, a significant share of publications is only published on-line and in other types of reports, and to ignore this research bears the risk of missing relevant studies. The peer-reviewed and non-peer reviewed sources have been kept separate in the analysis. Both groups indicate the same important factors, and it is striking to notice the complete agreement between the groups. The inclusion of non-peer reviewed sources has thus increased the validity of the review and broadened the scope and in-depth understanding of the transport service choice.

The research methods used in the studies, e.g. stated preferences, are also included in the analysis, and it is found that the different methods have similar results.

What separates this literature review from previous reviews is the focus on the actual mapping of real customer attitudes and preferences and also the widened scope, which includes non-peer reviewed sources.

Keywords: Transport service choice, modal choice, Europe, Sweden, literature review, mode selection

INTRODUCTION

The understanding of the factors underlying the selection of transport services is a key issue in understanding the freight transport market and designing a competitive transport system. The transport service choice for a customer is based on a number of factors that are considered and weighted against each other. For a service provider, e.g. a forwarder or a haulier, it is of key importance to understand which factors are important to the customer. Several studies have been made into transport service choices. The purpose of this paper is to make a literature review of previous studies on the transport service choice for freight and to identify important factors for the choice. What separates this literature review from previous reviews, e.g. Meixell and Norbis (2008) and Karlsson (2008), is the focus on the actual mapping of real customer attitudes and preferences and also the widened scope, which includes non-peer reviewed sources.

BACKGROUND

Compared to passenger transport, the choice of transportation solutions for freight transport is a more complex process that includes a greater number of actors, where the different actors have different values, perceptions and criteria for the selection of transport solutions (Woxenius and Bärthel 2008). Actors include shippers (consignors, consignee), transport operators, logistics service providers, forwarders and other intermediaries (Sjöstedt 1994, 1996). It is in a continuous interaction between these actors based on attitudes, perceptions, hard data collection, analyses and perhaps prejudices that the transport choice is made. A choice made by just one or a few individuals might affect a large number of consignments over a long period of time.

Understanding the factors behind these choices is important for several reasons. From a society perspective, the information can be used for the development and use of macro models or forecasting models, e.g. for infrastructure investments. It can also be used for development of international, national or regional transportation policies, e.g. promotion or support for certain transport modes. From a business perspective, the information can be used in the development and marketing of transport solutions.

A transport company must understand its customers to develop the transport solutions that the customer requires. Society must understand the behaviour of the transport actors to be able to support them or to try to influence their behaviour in different directions. A typical example of this is the current focus on promoting rail transport as a means of reducing carbon dioxide emissions and creating a sustainable future. This cannot be achieved unless the demands from the market

are known. Thus, there is a great interest in transport choices, both from the transport industry and society.

A large number of studies have been made into the factors behind the transport choice. It is important to review these studies and summarise the results to help reach a common understanding of the most important factors affecting the transport choice.

METHODOLOGY

The review focuses on peer-reviewed European studies during the last 19 years, from 1990 to 2009, published in the English and Scandinavian languages (Swedish, Danish and Norwegian). The peer-reviewed studies are complemented by non-peer review publications from the Scandinavian countries. It is a fact today that much research is only published on-line and to completely ignore this research bears the risk of missing relevant studies. The non-peer reviewed publications have been limited to Scandinavian publications, as it would not be realistic to find and access all types of publications in all European countries in all languages. Scandinavian publications were selected since the authors are Swedish and are familiar with the publications in the Scandinavian area. However, it is important to notice the potential difference in research quality between these groups and to keep them separate when analysing the data.

The review includes studies on European conditions where the actual opinion of the transport customer has been studied through interviews and surveys. It does not include modelling approaches or analyses based on statistical data. Cases studies were also excluded. To only include studies that have directly collected data from the transport customer is likely to come closest to revealing the real influencing factors.

The scientific database Science Direct was used to find peer reviewed articles. A list of relevant actors and activities were identified and used in the search in the title, abstract and keywords. The actors identified were shippers, forwarders, carriers, transport customers, hauliers, transport service providers, logistics service providers, consignors and consignees. The activities identified were selection, perception, preferences and behaviour. Each combination of actor word and activity word were used in the search, e.g. shipper perception, shipper preference. In addition to this, the words modal choice, mode choice, modal split and freight service selection were used in separate searches. The search was made in article title, abstract and key words.

Google and Google Scholar were used to search the Internet with the same key words as those used in the scientific databases. A challenge during the Internet search was to reduce the number of hits as, e.g. "modal split" generated 2.3 million hits. For obvious reasons, it is impossible to check all Internet hits. Each search was therefore further refined by adding to the search transport related words that are likely to occur somewhere in the text, such as forwarder, freight, road and rail. We do not claim to have made a complete search of the Internet as this is

impossible, but we do believe we have made as thorough a search as possible within a reasonable time frame.

Previous reviews, e.g. Karlsson (2008), were also used to find relevant articles. The reference lists of all found articles, reports etc. were also checked for relevant references.

GENERAL STATISTICS ABOUT THE REVIEW

In total, 27 relevant papers were identified through the literature search. The number of papers studied was larger, but for one reason or another they did not meet the criteria specified initially in the limitations. As mentioned previously, one of the contributions of the current paper is that not only peer-reviewed sources have been included in the study. Figure 1 below illustrates the **types of sources** used in the literature review.

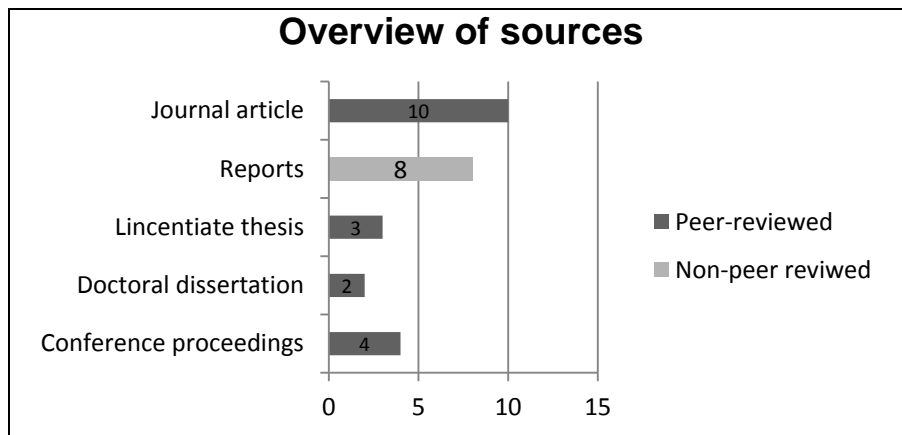


Figure 1 - Overview of the sources (number of sources)

As one can see, a large part of the sources can be attributed to journal articles and various types of reports (19/27). The latter is a diverse group, comprised of reports produced by research consultancies, government agencies and universities. Licentiate theses are theses developed during licentiate studies (intermediary degree towards PhD). Both groups, licentiate theses and doctoral dissertations, contain research work exclusively from Swedish universities. A reason for this might be that doctoral dissertations are often not publically published or not widely distributed. As the authors to this review are Swedish, it is therefore likely that we have greater access to these dissertations. There is also a tradition in Sweden to write dissertations as standalone books and not as a number of journal articles which might be the case in other countries. The found conference proceedings (4) are from NOFOMA and WCTR conferences. The conference proceedings were mainly found through Internet searches and reference lists in other papers. There is an obvious lack of a common database for conference proceedings to facilitate the search for conference papers. From the 27 sources reviewed, 20 are peer-reviewed (articles, dissertations and conference proceedings) and 7 are non-peer reviewed (reports).

As the literature search was performed in several **languages**, identified relevant papers include sources in three languages: English, Swedish and Norwegian, with a majority in English (see Figure 2 below). Most sources are in English as it is the most commonly used language in international journals and research. It can be seen that almost all of the peer-reviewed studies are in English. Non-peer reviewed studies are mainly in Swedish, which is natural since only non-peer reviewed studies from the Scandinavian countries are included in this study. Having several studies from Sweden is due to the origin of the authors and a familiarity with the research area and knowledge of where to find sources.

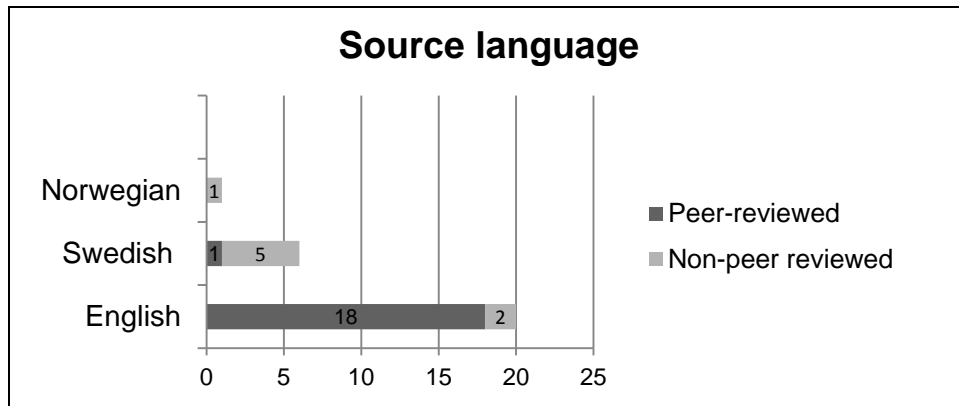


Figure 2 - Source language

The literature review only contains studies published after 1990. Figure 3 below shows the historical view on the literature included in the review. As one can see, a majority of the sources (67%) were published in the second decade of the 20-year period included in the review, after the year 2000. As suggested by Woodburn (2003), it could be the case that transport service choice issues are gaining importance among shippers as road transport costs increase and congestion creates problems in the current solutions.

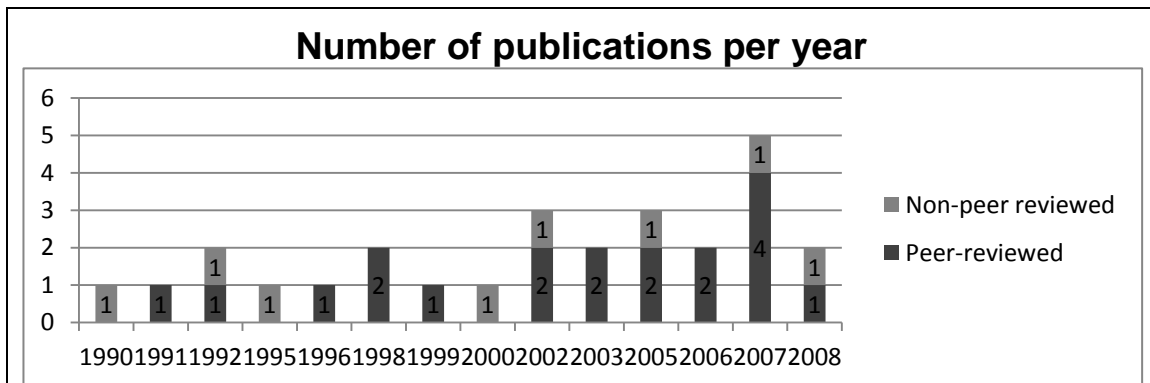


Figure 3 - Historical view on the literature reviewed (number of publications per year)

Another interesting characteristic is the **countries and regions covered by the studies** included in the review (see Table 1 below). A majority of the papers reviewed focus on Northern Europe. Most of the studies use data only from one country (often even a specific region within the country), while three studies out of 27 do include a larger region (constituting several countries). Interestingly there are no papers (see Figure 4 below) from large countries in Europe, such as Germany or France. This might be attributed to the fact that relevant research is published in local languages, and thus is not a part of the current review. Also, from the Netherlands, known to have extensive transport operations, there is just one source. As discussed above, the country coverage is partly attributed to the limitations imposed by the authors' language skills.

Table 1 - Countries/ regions covered in the studies (number of papers per country/region)

Studies focusing on one country	
Country	Number of studies
Austria	1
Belgium	1
Greece	1
Sweden, Norway, Denmark, Finland	1
Finland	1
Norway	1
Netherlands	1
Italy	3
UK	2
Sweden	12
Total:	24
Studies focusing on a region (several countries)	
Countries/Region	Number of studies
Italy & Switzerland	1
Nordic countries and Central & South Eastern Europe	1
Europe	1
Total:	3

Regarding the **methods** applied in the reviewed literature, the following observations can be made. Most of the papers utilized one specific method for gathering data from respondents, while 2 out of 27 papers applied a combination of multiple methods for gathering the data (thus the numbers presented in the figures below regarding the different methods used will not be equal to the total number of studies included in the review). Based on the interaction with the respondent, the papers can be divided into direct interaction (interviews, researcher-administrated survey) and indirect interaction, with direct interaction being applied 1.5 times

more than indirect (18 vs. 12). With direct interaction, the researchers and respondents have direct contact and talk to each other. This helps to ensure that the respondent is the intended respondent (e.g. the transport manager) and allows the respondent to ask questions if anything is unclear. With indirect interaction, the respondent and researcher are never in direct contact, e.g. only in contact through a mail survey. It is then difficult to know who actually completed the survey although this approach is less time consuming. Within these categories, it is possible to distinguish some sub-groups. In the case of direct interaction, 5 out of 18 were conducted via telephone, 6 were conducted as personal interviews (face-to-face), and as for the remaining 7, the exact conditions were unspecified (see summary in Table 2). The table below also indicates which of the studies belong to the peer-reviewed group and which to the non-peer reviewed group.

Table 2 – Direct interaction (number of times applied)

Method of data collection	Not specified	via Telephone	Face-to-face	All together
Direct interaction	7 (6 peer-reviewed & 1 non-peer reviewed)	5 (4 peer-reviewed & 1 non-peer reviewed)	6 (4 peer-reviewed & 2 non-peer reviewed)	18 (14 peer-reviewed and 4 non-peer reviewed)

In the case of indirect interaction, all were self-administrative questionnaires. Three out of 12 were completed as mail surveys, 2 via Internet and in the remaining 7, the exact conditions were not specified (see Table 3).

Table 3 – Indirect interaction (number of times applied)

Method of data collection	Not specified	via Mail	via Internet	All together
Indirect interaction	7 (4 peer-reviewed & 3 non-peer reviewed)	3 (2 peer-reviewed & 1 non-peer reviewed)	2 (2 peer-reviewed)	12 (8 peer-reviewed & 4 non-peer reviewed)

The methodology used for the studies was either qualitative interviews, Stated Preference (SP), Revealed Preference (RP) or traditional survey.

Table 4 - Application of different analysis techniques (number of times applied)

Data collection method	Method	Number of times applied
Indirect interaction	SP	1
Indirect interaction	Traditional survey	8
Direct/indirect interaction	Interview & survey	3
Direct interaction	Traditional survey	1
Direct interaction	SP	7
Direct interaction	RP	1
Direct interaction	SP& RP	3
Direct interaction	Qualitative interview	3

A list of all articles, methods, analysis techniques, countries and types is available in Appendix A.

REVIEW

The review is divided into three parts. First the key factors are presented followed by other factors. Next, the background factors are presented. The factors are then analysed in the analysis chapter. A summary of the key findings in all articles is available in Appendix B.

A striking discovery when comparing the articles is the lack of common definitions and common studied factors. Studies range from simply including 3-4 general factors (e.g. cost, time) to including more than 30 detailed factors. Naturally, there will be overlap between the factors in different studies. In many cases, the factors used are not defined at all. A general statement for e.g. “time” or “quality” is difficult to value and compare without the underlying definition. Therefore, it is impossible in this review to provide any clear definition as to what is included in the factors. The factors used here should be interpreted as a fairly wide and general description of the terms.

The studied texts all focus on the transport service choice, but the results are presented very differently. A few, e.g. Ludvigsen (1999), SIKa (2002), Vannieuwenhuysen et al. (2003), Berdica et al. (2005), Lamngård (2007) and Engström (2007) present ranking lists of the most important factors, but most results are presented as trade-offs. This could be either the respondents answer to a given statement, e.g., “Are you willing to replace your current transports with environmentally friendly transport if the price is increased by 10%?” (Posten, 2008) or a

calculated trade-off, e.g., 1% point increase in reliability is valued equivalent to a cost reduction of 770 Austrian schillings per shipment (Maier et al., 2002). The results within the same text might also be difficult to compare. For example, a 15% change in frequency and a 19% reduced risk of delay are both worth a 1% change in transport cost (Lundberg, 2006). Does this mean that frequency in general is more important than delays or is it the opposite? How should 15% and 10% for the factors be compared? This further makes the results difficult to compare.

Key findings

A number of key factors are recurring in most of the articles. These are cost, transport quality, transport time and reliability. The scope and definitions of factors are varying, and are also not strictly defined in most of the papers.

Cost

The most obvious factor that is mentioned in all articles is cost. Not surprisingly, cost is ranked very high. Cost is ranked as the most important factor by Widlert (1990), Widlert & Lindstedt (1992), Vannieuwenhuysse et al. (2003), Lundberg (2006), Punakivi & Hinkka (2006), Danielis & Marcucci (2007), and it is among the top factors in most of the other studies.

Several studies also show that cost is important, but it is not necessary to have the lowest cost as other quality factors are also included in the mode selection (Fridstrøm and Madslie, 1995; Danielis et al., 2005, SIKÅ, 2005; Lammgård, 2007). The studies by SIKÅ (2005) and Lammgård (2007) both ask about the importance of a low price/one of the lowest prices and both score low in importance. The survey by Lammgård also asks the same respondents to distribute 100% on the factors price, transport time, on-time delivery and environmental efficiency according to their importance when selecting transport solutions. The respondents then attributed 58% of the weight to price, despite previously ranking price as a factor of low importance. See also Saxin et al. (2005) for more results from the same survey.

The importance of cost is also shown by the fact that several studies use cost as a benchmark to value other factors against, e.g., how much is a shorter transport time worth?

Transport quality

Transport quality is a very wide factor that could include many things, such as time, reliability, frequency, risk of damage, etc. Some studies include a number of these factors separately, while other studies use the term transport quality as a single factor. When the factors are used separately, they will be presented separately in this review.

Transport quality is ranked as most important by all studies that include it as a single factor (Anderson & Browne, 1992; Björklund, 2002, 2005; Punakivi & Hinkka, 2006). Similar results are also found by Lammgård (2007) where a variety of quality related factors are ranked as most important. Most studies do not include transport quality as a separate factor, but rather in the analysis mention that the factors identified as most important relate to transport quality, e.g. Danielis et al. (2005). It is obvious that transport quality is of high importance. However, transport quality is a very vague term and can be interpreted to include almost anything, which might explain its popularity. If the decision has been made to transport something, it is fair to assume that one of the basic requirements of the transport is that it should deliver the goods in a proper way. It is difficult to imagine any situation where a transport buyer would request a low transport quality for its transport.

Transport time

Transport time is considered one of the most important factors by Fowkes et al. (1991); Hellgren (1996); Maier et al. (2002); SIKa (2002); Berdica et al. (2005); Punakivi & Hinkka (2006); Danielis & Marcucci (2007) and REORIENT (2007). However, the picture is a bit divided with some studies attributing a low importance to time. The importance of transport time diminishes with a longer expected transport time (Danielis et al., 2005). The study by Golias and Yannis (1998) found that the customer is not willing to pay more for reduced transit time, but willing to accept longer transit time for lower rates. Similar results were found by Fridstrøm & Madslie (1995). Widlert & Lindstedt (1992) and Engström (2007) also attribute a low value to transport time.

Reliability

Reliability can also be defined as on-time delivery. It is ranked as one of the most important factors by Hellgren (1996); Laitila & Westin (2000); Maier et al. (2002); SIKa (2002); Vannieuwenhuysse & Gelder (2003); Berdica et al. (2005); Danielis et al. (2005); Punakivi & Hinkka (2006); REORIENT (2007) and Engström (2007). The importance of reliability is different for different commodity groups and depending upon the delivery time that has been promised by the transport company. Fridstrøm & Madslie (1995) found that the value of delay (a 1% unit increase in risk) varies from 2% of the transport cost for general cargo with no specific delivery time to 13% for food with delivery time within a one hour time window. Danielis et al. (2005) and REORIENT (2007) also find that reliability is less important for rail than for road. This is probably a result of the fact that rail is often used for low valued goods, e.g. bulk goods, and already has a relatively long transport time. The importance of reliability is found to be reduced for longer transport times (Danielis et al., 2005).

Other factors

The studies also highlighted a number of other important factors.

Environment

A sustainable society, climate change and pollution have become important to the transport industry. However, these factors are seldom included in the studies. Surprisingly, only 11 papers out of 27 mention environment as a factor influencing modal choice. Moreover, 5 out of these 10 are studies with a special environmental focus (Laitila & Westin 2000; Björklund 2002; Björklund 2005; Lammgård 2007, Posten 2008), 2 focus on the potential of using intermodal transport (Berdica et al. 2005; REORIENT 2007), 1 on rail transport (Engström 2007) and 1 on the influence of future demands on transport companies (Rohani & Lumsden 1998). All of the studies that do consider environment have been published in the second decade of the literature review period.

The studies that did include environment as a factor mainly found the importance to be low. The results are also difficult to compare as they are expressed in different ways. For instance, Lundberg's (2006) results show that 50% less of environment impact is valued at 2% less cost, which means environment is not a very significant factor and not much value is seen in reducing the environmental impact. Similarly, Berdica et al. (2005) found environment to be the least important factor. Rohani & Lumsden (1998) state that environment is gaining importance, and according to the transport buyers studied, environment was valued equally with information technology, ranked as the 5th and 6th most important factors. Posten (2008) found that more than 54% of the respondents are not willing to change to environmental friendly transport if transport time is increased by 24 hours and 53% are not willing to change if the price is increased by 10%. Only 20% and 15%, respectively, say it is likely that they would change. Moreover, Lammgård's (2007) survey showed a very low willingness to pay for environmental considerations of transports, though larger manufacturers scored better. Still, the overall results were quite low given only 5% of the weight when selection of transport solution was attributed to the environmental impact. On the other hand Laitila & Westin (2000) showed environment to be valued higher than transport time and frequency, which are very common factors in the mode choice decision-making. However, environment is considered less important than reliability.

Frequency

Frequency indicates how often departures are offered. It is not studied specifically by many studies but is ranked as a factor of medium importance (Laitila & Westin, 2000; SIKÅ 2002; Maier et al., 2002; Berdica, 2005; REORIENT, 2007; Engström, 2007). It is given a low ranking by Danielis & Marcucci (2007).

Goods damage and security

Goods damage is studied by Widlert & Lindstedt (1992); Fridstrøm & Madslien (1995, Vannieuwenhuysse et al. (2003); SIKA (2005); Danielis et al. (2005); Danielis & Marcucci (2007) and Lammgård (2007). Damage is rated as rather important, e.g. rated as number 6 in importance (Lammgård, 2007), number 5 (Vannieuwenhuysse et al., 2003), number 3 (SIKA, 2005), number 2 (Danielis & Marcucci, 2007). In monetary terms, the interest of spending money to reduce the risk of damage is low. Fridstrøm & Madslien (1995) show that 1% unit increased risk of damage is worth only 0.5% of the value of the goods (12% of the price). In general, goods damage is not considered to be a problem among transport customers, which can explain that the incentive to reduce goods damage is less than the corresponding value of the goods.

Information technology

IT services are seldom included in the studies. Engström (2007) ranks information systems as one of the least important factors. REORIENT (2007) asks about information promptness on cargo under shipment and after arrival and also about track and trace services, where both concerns end up in the middle and lower part of the priority list. Golias and Yannis (1998) conclude that existence of computer communication has a positive effect on influencing a switch from road to intermodal transport.

Transport mode

This section analyzes whether studies included in the literature review have revealed any bias or preferences among the respondents concerning modal choice decisions, e.g. whether to use rail or road.

Surely there is high dominance of road users among the respondents in the studies included for the literature review. For example, Danielis et al. (2005) in their study of Italian logistics managers found that 83 out of 93 used road transportation. The study by Lammgård (2007) shows a high proportion of shippers using road transport. Similarly, Vannieuwenhuysse et al. (2003) study also showed that road haulage is the preferred mode of transport. Bias towards other modes was confirmed in the study done by Maier et al. (2002), who found that investigated Austrian shippers try to avoid rail even if other conditions are equal, and are willing to pay an extra cost for doing so. Moreover, the study by Vannieuwenhuysse et al. (2003) revealed that users of a specific transport mode gave that mode a higher score than non-users, thus implying that often the bias towards other modes is due to lack of experience or knowledge about other modes.

On the other hand, study by Golias & Yannis (1998) found that a majority (78%) of the carriers included in the study were ready to transfer from road to intermodal road-rail transport if it would

positively affect their profits. Forwarders' study showed that willingness to switch was much weaker (52%), and both groups indicated that more financial support is necessary to enable the shift. As can be seen, results of the different studies are often contradictory, and thus further investigation into the issue is highly suggested.

Important individual factors

Some factors are only included in one study, but are ranked as very important. Government subsidies for purchasing intermodal transport equipment are ranked as the most important factor in the study by Golias & Yannis (1998). Note that this study specifically concerned important factors for a modal shift from road to rail. Scheduling and convenience is considered as the second most important factor in the study by Punakivi & Hinkka (2006). Scheduling should probably be interpreted as a general suitable timetable, although it is not defined in the article. Notification time is included in the study by Maier et al. (2002) which attribute a slight economic cost to a reduction in notification time.

Background factors

In analyzing the results of the study, it is important to consider the settings in which the study has taken place (McGinnis 1990; Murphy & Hall 1995). Many authors within the mode and carrier selection literature have addressed the question of background factors. For instance, Murphy & Daley (1997) and Meixell & Norbis (2008) draw attention to the importance of individual factors in mode choice, such as **industry and company** characteristics. Similarly, Punakivi & Hinkka (2006) and Patterson et al. (2007) found differences in importance of selection factors based on the type of freight. However it is obvious that industry/type of goods factor will be an important determinant in mode choice decisions (for example: transport needs for bulk goods will always be different from consumer goods).

Considering the **types of respondents** is important as their background (experience with different modes of transport) and position in the company may influence their decision-making. Based on the limited information provided on respondents, it is, however, difficult to assess whether respondents' background and position has any influence.

Though often these background settings are vaguely presented in the research, three main factors have been selected: industry, size of the companies, and types of respondents. Consideration of such factors is important, as they may often help in understanding and interpreting the results of the studies performed.

It is interesting to note that not only which industries, size of companies and types of respondents have been included in the mode choice studies in Europe, but also whether or not

the authors have mentioned these background factors. In a way this is an indication of whether or not the authors have considered these factors to have a potential influence on the results of the studies carried out. The following discussion will present the findings on each of the background factors chosen.

Industry type

Only four out of 27 papers have not mentioned the industries included in the study (Widlert, 1990; Danielis et al., 2005 and Engström, 2007; Rohani & Lunsden 1998). Similarly, Anderson & Browne (1992), did not specify exactly the industries included, but stated that the choice was made according to the freight most suited for transport on rail (higher than average density). Most of the studies do not focus specifically on any industry, but include an array of companies from different industries. Predominance towards shipping can be found in SIKA (2002); however this was a result of the random selection of respondents. Thus, all in all, authors do cover this background factor; however, just a few include the industry factor in analysis of the results, and most of the studies present aggregate results.

Size of the companies

In the papers studied, 10 did not note anything regarding the size of the companies studied, several included companies from different ranges (Golias & Yannis, 1998; Ludvigsen, 1999; Danielis et al., 2005; REORIENT, 2007; Lamngård, 2007) while others focused more on larger companies either using the number of employees or annual turnover as the criteria (Widlert, 1990; Anderson & Browne, 1992; Hellgren 1996; Widlert & Lindstedt, 1999; Maier et al., 2002; Björklund 2002; Björklund 2005; Posten, 2008; Rohani & Lumsden 1998).

Interestingly, there is no discussion in the papers as to whether size allows companies to be freer in their choice of mode, as obviously economies of scale are important for certain modes.

Types of respondents

From the papers reviewed, 11 did not specify who exactly the respondents were, which constitutes more than a third of the papers. None of the papers thoroughly discussed the issue or how it may influence the results of the studies. The most common description about the respondent is only that data has been gathered from people responsible for purchasing logistics, transport or distribution. Several also specify that respondents have been managers from the corresponding area (Fowkes et al., 1991; Hellgren, 1996; Maier et al., 2002; Danielis et al., 2005; Punakivi & Hinkka 2006; Danielis & Marcucci 2007).

ANALYSIS

Important factors

The importance of cost is not surprising considering that the actors are commercial companies who must make a profit to survive. Understandably, no company is willing to pay extra for, e.g. environmental friendly transport, if they risk going bankrupt or losing customers over it. Any extra cost incurred must be covered by an increased revenue generated from it. This could be in direct savings, e.g. reduced goods damages, or in increased revenues, e.g. more customers attracted by offering environmental friendly transport or a possibility of charging a premium price for a high quality product/service.

The first, direct savings, is related to internal factors and can be easily calculated. The second, increased revenue, is much more difficult to estimate. For example, Lamngård (2007) shows that it is difficult to use the environmental argument to sell transport services. This is particularly true if the positive effect is occurring several tiers away in the supply chain. Increasing environmental awareness, e.g. among the grocery store shoppers, has yet to impact the transport service choice of the transport customers further back in the supply chain.

Quality and quality-related factors are also high on the list of importance. It appears that the transport choice is made in two steps. First, the transport quality is evaluated. If the quality is satisfactory, the transport choice is made almost solely based on price. Quality factors are important, but they do not appear to increase in importance with better performance. For example, an increase in transport time has a negative value, but a reduction in transport time does not necessarily have a positive value. Some basic quality requirements must be met, but once they are, the transport customer is not willing to pay extra to improve them any further.

It is also interesting to note that the study by Danielis et al. (2005) finds that the quality requirements, in particular time, are more important for outbound shipments than for inbound shipments. The companies seem to be more concerned with their customers' delivery times, than with their own. This can be explained by the fact that the shippers and receivers are in different industries, but it could also indicate that the shipper attributes more importance to the quality factors than what is really required by their customers.

Analysis and collection methods

A number of different methods are used to collect data and to analyse it. We cannot find that there are any differences in results based on the different methods. However, the results are presented differently depending on the method. SP articles present their data more frequently as trade-offs between different factors, while traditional surveys are more prone to ranking lists.

This can be explained by the fact that SP is about letting the respondents compare different options, which makes a trade off a natural result. Traditional surveys are more about attributing weight and scores to the individual factors, which easily translates into rankings. A bit surprisingly, interview studies present ranking lists rather than trade-offs.

Peer-reviewed vs. non-peer reviewed articles

This review included both peer-reviewed and non peer-reviewed articles which separated this review from previous research. About two thirds (19 of 27) of the articles are peer-reviewed (published in scientific journals, conference presentations and doctoral/licentiate theses). We can find no difference in results between the two categories. Both rank the same factors as important. There are, of course, differences between individual studies, but the difference is not larger among the peer-reviewed texts than among the non peer-reviewed.

Most of the non per-reviewed texts are written by university researchers or by well established consultancy firms and research institutes. Although we have not reviewed the quality of the research, it is likely that these experienced researchers use a similar methodology and approach as they would if they wrote a peer-reviewed paper. Of course, this does not imply that all non-peer reviewed texts have a high research quality and can be trusted, but we cannot find anything that supports a general statement that non-peer reviewed texts cannot be trusted.

The Internet search for articles often returned references to the same articles as in the scientific database, either through direct hits on the journal's home page or through references. In fact, it turned out that in many cases, it was more efficient to use Google to find scientific articles than the dedicated scientific databases. This was particularly true if the name of the article was known.

Sources

The aim has been to review the transport service choice literature, with a focus on European conditions. Non-peer review reports from the Scandinavian countries have also been included. The peer reviewed journal articles constitute a fairly even geographical spread across Europe. However, some large countries such as Germany and France are missing. It is reasonable to suspect that such studies also exist in those countries. This lack of studies might be explained by looking at the non-peer reviewed sources. The large number of non-peer reviewed sources found in Swedish in this study, indicates that most likely similar studies also exist in other countries. It is obvious that the interest in e.g. French transport customers' preferences is naturally largest in France, which might explain why many of these studies probably are published only in local languages. This constitutes a problem for researchers since the access to local reports, such as government reports and consultancy reports, are limited in many

countries. Even if they are public, they are difficult to find for a non-native researcher, and, of course, impossible to read if you do not understand the language. It is clear from this study that a large number of relevant research reports are published outside of the general scientific journals.

It should be noted that non-peer reviewed reports outside Scandinavia and peer reviewed articles published in languages other than English or those of Scandinavian countries were not included in this study.

From the general statistics about the review, it is interesting to note the high percentage of studies published after the year 2000. As discussed above, this is likely due to the increased problems associated with road transport, e.g. congestion and environmental pressures, which have caused a growing interest towards modal choice. The political interest in a modal shift towards rail is probably also a contributing factor. As modal shift is a key priority in the European Transport Policy (European Commission, 2001), albeit with limited results so far, it is likely that research on modal choice will also receive much attention in the future.

Research descriptions and definitions

In many cases, the research process is poorly described with lacking data on the type of respondent, industry, the year in which the study was performed, selection of respondents, etc. However, what is more important is the lack of definitions of the factors studied. This makes the results difficult to interpret for the reader and also raises the question as to how the respondent interpreted the factor. One example is described by Posten (2008) who asks the respondents if they are willing to switch to “environmental friendly transport” without explaining what they mean by the term. It is safe to assume that the respondents have interpreted it very differently. Not everything can be defined, and sometimes it might be beneficial to use a loose concept, but it is our opinion that authors should spend more time on defining the factors they are studying. This lack of common definitions makes it difficult to compare the results in this review. Naturally, it is impossible for everyone to use the same factors and definitions (although it would make a review like this much easier), but a clear definition would simplify a comparison.

The texts very rarely discuss any methodological problems or shortcomings with their methods. For instance, in the case of researcher-assisted surveys there are personal factors involved. Additionally, respondents may feel somewhat pressured to give proper and expected “responses” (for example on their concern about environmental issues in transport decisions etc.). Other methodological problems rarely discussed include ensuring that a self administered survey is filled out by the intended respondent, with the noteworthy exception of Lammgård et.al (2004). This is probably caused by lack of space in journal articles and a belief that the reader is familiar with the methods used. However, we believe it is important to also highlight potential

problems with the study performed and to see which, if any, steps the authors have taken to prevent problems.

Many articles collect data from the respondents and then using different mathematical models try to estimate cost elasticities, correlations, valuations, etc. It is sometimes difficult to determine if the results in an article are derived from data directly gathered from the respondent or if they are a result of the mathematical analysis.

Results are often presented as a percentage of something, e.g. costs, but not all articles are clear on whether this refers to percentage or percentage units. The difference might obviously be substantial, for example, if the reduced risk of delay is 1% or 1 percentage unit.

Transport mode and attitudes

Several of the studies showed that most of the shippers are heavily dependent on road transportation, which surely is not anything new. The reasons behind this are most likely the accessibility, convenience, and speed of road transportation, not to mention a long tradition of using road transportation. As suggested by Jensen (2008), for many shippers transport cost only constitutes a small proportion of total product cost, thus making customers change the supplier must provide strong incentives, for example dissatisfaction with the currently offered service, a cheaper alternative or pressure from government on reducing environmental impact from the transportation. Obviously these pressures, despite the policy efforts, have yet not had a significant impact.

An interesting finding is the fact that attitudes towards modes depend on the experience shippers have with the different modes. More specifically, quality aspects of certain modes were rated higher by shippers having experiences with that particular mode. Thus attitudes and perceptions may play an important role in mode choice. Gaining and distributing information and knowledge in working with different modes is crucial to breaking these barriers.

Environment

Environment as a factor influencing transport service choice is by and large ignored both by researchers designing studies as well as respondents answering the studies that do include environment as a factor. Moreover, environment has only been included by studies specifically focusing on environmental issues, or rail or intermodal transport, thus general mode choice studies do not pay attention to it. The studies that did include environment showed clearly that it is given a low priority in the transport choice. There is definitely a need to investigate the environmental factors in the future, as policy pressure is growing and problems in road transport (cost, congestion, etc.) are on the rise.

CONCLUSION

The aim of the current study has been to make a review of studies on factors underlying the selection of transport service in European conditions. The review finds that the core factors important for the transport service choice are cost, transport time, reliability and transport quality. After ensuring that the basic transport quality requirements are met (e.g. on-time deliveries, transport damages, transport times), most of the decisions are made based on price. But the willingness to pay for lower environmental impact is low. Rail is perceived as being more environmental friendly, although several studies mention a negative attitude towards rail.

The environmental effects are widely neglected by the studies unless the study has a specific focus on environment. This is quite surprising considering the large attention given to the environmental effect of transport in virtually all other fields of transport research.

To compare and draw detailed conclusions from the studies is, however, difficult as there is lack of common definitions of the factors. In many cases, the factors used in the study are not defined at all. The number of factors may vary greatly (some authors use a few very general factors, while others uses a large number of very specific factors) and results are presented in very different ways. A comparison between the studies is further complicated because of the lack of description on the settings of the studies, e.g. background factors such as respondent data.

The review included both peer reviewed and non-peer reviewed sources, which separates this review from previous studies. Such an approach gave a wider picture of the transport service choice research. Interestingly, no differences were revealed in the findings obtained by the two groups.

The review also found a lack of repetitive studies over time, where similar factors have been used in similar settings. This would have made it possible to see if transport buyers have changed their preferences throughout time. The second decade of the period studied shows an increase in the number of mode choice studies, which suggests that mode choice decisions are becoming more important. However, the data does not support any longitudinal studies.

FURTHER RESEARCH

Based on the shortcomings detailed in the conclusion section, the authors strongly advise further research on mode choice decisions in Europe. On one side it is important to bring together the studies made in different languages to obtain a more complete overview of the situation in Europe. From another side, an important guideline for future research is to bring more clarity and

comparability to the studies made. Also longitudinal studies are favoured to see the dynamics of important factors transport buyers apply in making mode choice decisions.

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APPENDIX A

Authors	Year	Methodology	Analysis technique	Country/region studied	Author type	Type	Peer reviewed
Widlert	1990	Interviews face-to-face (SP)	SP	Sweden (Northern region)	Consultant	report	No
Fowkes, Nash & Tweddle	1991	Interviews (SP)	SP, RP	UK	University	article	Yes
Anderson & Browne,	1992	Face-to face Interviews (SP)	SP	UK	University	conference	Yes
Widlert & Lindstedt	1992	Interviews face-to-face (SP & RP)	SP & RP	Sweden	Consultant	report	No
Fridstrøm & Madslie	1995	Interviews	qualitative analysis	Norway	Research institute	report	No
Hellgren	1996	Questionnaire	statistical analysis	Sweden	University	licentiate	Yes
Golias & Yannis	1998	Interviews (SP & RP) (structured)	SP, RP	Greece	University	article	Yes
Rohani & Lumsden	1998	Questionnaire	Statistical analysis	Europe	University	conference	Yes
Ludvigsen	1999	Interviews, telephone (RP)	statistical analysis (factor & regression)	Sweden	University	article	Yes
Laitila & Westin	2000	Questionnaire, mail (SP)	SP	Sweden	University	report	No
Björklund	2002	Interviews	qualitative analysis	Sweden	University	licentiate	Yes
Maier, Bergman & Lehner	2002	Interviews	qualitative analysis	Austria (four regions Villach/Klagenfurt, Linz/Wels, Graz and Vienna)	University	article	Yes
SIKA	2002	Questionnaire	statistical analysis	Sweden	Research institute	report	No
Bolis & Maggi	2003	Interviews (SP)	SP	Italy & Switzerland	University	article	Yes
Vannieuwenhuysse, Gelders & Pintelon	2003	Questionnaire (Internet)	statistical analysis	Belgium (Flanders)	University	article	Yes
Berdica et al.	2005	Questionnaire (telephone)	descriptive statistical analysis	Sweden (Jönköpings, Värmlands and Örebro)	Consultant	report	No
Björklund	2005	Questionnaire (mail)	statistical analysis	Sweden	University	dissertation	Yes

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Danielis, Marcucci, & Rotaris	2005	Interviews, Face-to-face (SP)	SP	Italy (2 regions)	University	article	Yes
Lundberg	2006	Interviews, telephone (SP)	SP	Sweden	University	licentiate	Yes
Punakivi & Hinkka	2006	Interviews (semi-structured focus) & Internet survey	qualitative & statistical analysis	Finland	University	article	Yes
Danielis & Marcucci	2007	Interviews, telephone & face-to face	SP	Italy	University	article	Yes
Dinwoddie & Vandewal	2007	Questionnaire	statistical analysis (hypothesis testing)	Netherlands (region in south)	University	conference	Yes
Engström	2007	Questionnaire & interviews	qualitative & statistical analysis	Sweden	University	conference	Yes
Lammgård	2007	Interviews, questionnaire (mail)	qualitative analysis, statistical analysis (factor and correlation)	Sweden	University	dissertation	Yes
REORIENT	2007	Questionnaire	statistical analysis (factor analysis)	Nordic countries and countries in Central- and South Eastern Europe	EU project	report	No
Chiara et al.	2008	Interviews (telephone)	SP	Italy	University	article	yes
Posten	2008	Questionnaire (telephone)	statistical analysis	Sweden, Denmark, Finland, Norway	Commercial	report	No

APPENDIX B

Authors	Year	Cost	Transport time	Reliability	Transport quality	Comment
Widlert	1990	Most important factor	10% change in transport time is equal to a 2% change in cost	A reduction in delays by 50% is worth 7% for (D). It is worth 4% for (T).	-	
Fowkes, Nash & Tweddle	1991	-	Half day longer valued at 5%-32% of transport cost, depending on type of product	1% more goods delivered on time is valued at 0.4%-5% of transport cost	-	Studies intermodal transport
Anderson & Browne,	1992	Second most important factor	-	-	Most important factor	Studies intermodal transport
Widlert & Lindstedt	1992	Most important factor	Valued at 30 SEK per hour. Average transport of 18 hours.	1% unit reduction in risk of delay valued at 110 SEK for (D). It is worth 280 SEK for (T) The same value for rail is 40 SEK and 60 SEK.	0.1% unit reduction in risk of damage valued at 270 SEK	
Fridstrøm & Madslie	1995	More important for hired transport than for own-account transport (90% of for hire). More important for own transport (FOB) than for transport ordered for a customer (CIF) (78% of own transport).	More willing to pay to avoid an increase in transport time, than to pay for a reduction. 10% reduction in transport time valued at 6% cost reduction for fresh food. Valued at 0% for frozen products. Other goods type valued between 1% and 2%.	1% unit reduction in risk of delay is valued at 8% increase in transport cost for food and 2% for other goods. Increases to 11-13% for (T) for food and 5-6% for other.	1% unit higher risk of damage is valued at 12% higher cost	
Hellgren	1996	-	Important factor	Decisive factor		Flexibility a important factor but less important than transport time
Golias & Yannis	1998	Second most important factor for mode change to intermodal is freight rates. 78% of carriers would transfer to combined transport for a 20% rise of their annual profit, whereas the corresponding percentage of forwarders is only 52%.	Not willing to pay for reduced transport times, but willing to accept longer transport times for lower rates.	-	-	Studies factors important for a shift to intermodal transport. Subsidies for investment in transport equipment most important factor

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Rohani & Lumsden	1998	Payment conditions: 4th most important factor (price must be as cheap as possible without reduction in any other requirements)	-	Included in transport quality	Second most important criteria (meaning: reliable, punctual, transport without damages)	Only studied road transport buyers. Market coverage-most important criteria; Flexibility -third most important; Equal importance: Environment & IT –fifth and sixth most important factors;
Ludvigsen	1999	-	-	-	Operational excellence is important, which includes efficiency, quality and reliability.	Studies only quality
Laitila & Westin	2000	Not willing to pay for better environmental performance	Shorter transport times are viewed positively.	On time delivery the most important factor	-	Studies the importance of environmental factors
Björklund	2002	More important than environmental performance	-	-	More important than environmental performance	Studies the importance of environmental factors
Maier, Bergman & Lehner	2002	Used as benchmark for the other factors	1 hour reduction in transport time is worth ATS 119 per shipment	A 1% point increase in reliability is valued equivalent to a cost reduction of ATS 770 per shipment	1 h reduction in notification time is worth 66 ATS per shipment	
SIKA	2002	A low price is given low importance (ninth most important)	Second most important factor	Most important factor	Security third most important factor	Capacity fourth important factor and regularity fifth. Frequency sixth important factor.
Bolis & Maggi	2003	-	Valued at 1.15 CHF per net ton for one hour reduction transport time.	Valued at 2.42 CHF per net ton for 1% more reliability	-	Flexibility valued at 0.37 CHF per net ton for one hour less notice time. Shippers have a clear preference for change when considering offers for transport services on rail.

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Vannieuwenhuyse, Gelders & Pintelon	2003	Most important factor	Fourth most important factor	Second most important factor	Safety is fifth most important factor	Flexibility is third most important factor
Berdica et al.	2005	Third most important factor	Most important factor	Second most important factor	-	Studies intermodal transport
Björklund	2005	More important than environmental performance	-	-	More important than environmental performance	Studies the importance of environmental factors
Danielis, Marcucci, & Rotaris	2005	Second most important factor	Third most important factor	Risk of delay fourth most important factor	Risk of damage and safety is valued as most important factor	
Lundberg	2006	3.8% price reduction to change transport company	A reduction in transport time by 16% is valued at 1% change in transport cost	A reduction in delay by 10% is valued at 1% change in transport cost	-	
Punakivi & Hinkka	2006	Most important for heavy machinery. Less important for electronics.	Important for pharmaceuticals and electronics. Less important for heavy machinery	Important for heavy machinery	Most important for electronics	Considers different commodity types
Danielis & Marcucci	2007	Most important factor	Third most important factor	Fifth most important factor.	Loss and damage second most important factor	Flexibility fourth most important factor.
Dinwoddie & Vandewal	2007	Little effect on modal split	-	-	-	Studied the effect of policy measures. Good interchange between modes important.
Engström	2007	Second most important factor	Frequency fourth most important factor and transport time fifth.	Most important factor	Risk of damage seventh most important factor and customer service eight	Flexibility third most important factor. Environment sixth most important factor.
Lammgård	2007	Very important, but not necessarily the lowest price.	-	Keeping promises and delivery times most important factor	Quality factors very important	
REORIENT	2007	Second most important factor	Medium importance	Most important factor	Damage third most important factor	For rail, service availability is most important factor

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Chiara et al	2008	Not important if both modes have the same price.	Most important factor was the effect of road driving hour regulations and the potential to use rolling highway for required rest. Frequency also important.	-	-	Studied modal choice between road and rolling highway on a specific route through the Alps
Posten	2008	53% of respondents not likely to change to environmental friendly transport if cost increases by 10%. 31% are indifferent.	54% of respondents not likely to change to environmental friendly transport times increases by 24 hours. 27% are indifferent.	-	-	Studies the importance of environmental factors

(S) = Same day deliveries, (D) = Specific day deliveries, (T) = Specific delivery time, ATS = Austrian schillings, SEK = Swedish kronor, CHF = Swiss Francs