

A significant and growing share of total CO<sub>2</sub> emissions and other harmful environmental impacts emanates from freight transports. Several measures are required to reduce these impacts, such as development of new motor and fuel technologies, behavioural changes, and, among the latter, a shift from road transport to intermodal road-rail transport.

Environmental arguments in the marketing of intermodal road-rail transports have not been used to their full potential in practice, and, further, they have hardly been emphasized so far in transportation research. Catrin Lammgård has devoted her doctoral thesis to this promising subject. Here, marketing should be understood not only from the carriers' perspective, but also from that of other actors aiming at promoting intermodal road-rail transports.

Catrin Lammgård develops a conceptual model for her thesis and examines shippers' transport characteristics, decision processes, buying behaviour and choice criteria in well designed empirical studies in order to identify the conditions and opportunities for using environmental factors in the marketing of intermodal road-rail transports. Market segmentation and differentiated marketing are keywords in her work.

This thesis lays a solid foundation for further scientific research on the subject and also for development of marketing strategies in practice.

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Catrin Lammgård

Environmental Perspectives on Marketing of Freight Transports

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The Intermodal Road-Rail Case

Catrin Lammgård



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## Abstract

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An obvious trend today is increased freight transports within the European Union, especially those on road while rail transports have a stable, smaller share of the transport market. This relation between transport modes mainly holds true for Sweden as well. Increased road transports have negative effects on the environment, which may obstruct a sustainable development; a goal in many political guidelines. Moving more freight off the roads and by rail instead, is desirable. At the same time, there are increased environmental demands on companies from stakeholders and therefore they pay attention to the environmental consequences of their business, including transports. A key process of influence is the freight transport buying. This task is executed by the logistics managers or equivalent, usually at the shippers of freight, and their decisions have a direct environmental impact e.g. choice of transport mode.

The development of intermodal road-rail transports has been slower than expected in Sweden, even if the volumes have been increasing during the last few years. The environmental aspect is a quality that these transports may capitalize on in order to develop marketing strategies based on differentiation and to use these strategies in competition with direct transport on road. The environmental aspect may be a competitive advantage and thus an opportunity to increase the market shares in Sweden. The **purpose** of this thesis is to explore the potential of using environmental arguments in the marketing of intermodal road-rail freight transports.

A theoretical framework is elaborated that brings together theory in marketing, logistics, purchasing and environmental management. This results in a proposed theoretical main model for the marketing of environmental advantages in freight transportation. After this, three research questions are identified that then guide the empirical data collection: (1) What impact do environmental aspects have on shippers and their customers? (2) If environmentally preferable transport services are offered, are they value-adding to the shippers? and (3) Is it effective to use environmental arguments in marketing strategies of intermodal road-rail transports?

The first collected data was through an explorative interview study among shippers regarding how they work with environmental issues in connection to their freight transports. The results are summarized in a model showing the environmental considerations in the logistical decision-making process. Also, the results generated input for the second empirical study – a telephone-initiated survey. The methodology and survey design is described quite thoroughly in order to identify the theoretical and practical problems when a survey is carried out, and the consequences for reliability and validity.

The target population in the survey consisted of active companies having transport exceeding 150 km and this lower distance limit was set in order to focus on potential freight for intermodal road-rail transports. The survey data collected from shippers forms a foundation for the freight transport demand. These results provide basic data about the actual freight flows in terms of estimated total volume, destinations, lengths and transport modes. The most important practical contribution though, is the survey results reflecting the attitudes and preferences of shippers regarding environmental considerations (especially in relation to their transports) and in combination with other aspects. All results are examined in the light of the opportunities and barriers for marketing of intermodal road-rail transports.

According to the proposed theoretical main model, the shippers' transport service requirements are based on their logistical, economic and environmental needs. These demands are put on the transport sellers and brought into their marketing context. This can be used by promoters and marketers of intermodal road-rail transports based on environmental advantages. A customer segmentation of shippers is made based on company size and trade of business in the first stage, and then further by classifying them based on their environmental needs, their priority of price and their potential for intermodal road-rail transports. All these needs and preferences are weighted together in a resulting total marketing priority matrix for marketing efforts of intermodal road-rail transports based on environmental advantages. It shows that the target groups would mainly be large manufacturing companies, but also medium manufacturing companies and large wholesale companies. The model shows that customer segmentation can be used in a differentiated marketing strategy including e.g. transport service differentiation and marketing communication with different segments. The result is customer value for the shippers, which is weighted together with price (originating from the transport sellers' service production context), which enable the shippers to make a final choice of transport seller(s).

The results are discussed in terms of a marketing context among transport sellers, but they are intended to also be useful to other parties interested in developing environmentally preferable transport services e.g. to policy-makers. The results contribute to the examination of the potential of Swedish companies contributing towards achieving a sustainable transport system in a voluntary way, or as a knowledge basis for public policy decisions.

## Acknowledgements

---

There is a great amount of time and effort invested in a PhD thesis. Anyone who has been through this process can verify that and it is a special experience. It is above all a learning process, built on reciprocal sub-processes:

This learning process naturally involves *academic learning*. The prerequisite has been all persons in industry who shared their knowledge in interviews and as survey respondents. However, this learning would not have been possible at all without the support and advice from a number of persons at the university:

- My supervisor Professor Arne Jensen believed in me and gave me the freedom to test my own ideas. His guidance made this thesis possible.
- Professor Jan-Erik Vahlne and Professor Tommy Andersson contributed with their constructive criticism at the final seminar that helped me in finalizing this thesis.
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- Dr. Cecilia Solér helped me with comments on the planned direction in the early stages at the planning report seminar.
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...my spontaneous and affectionate Leo, who although would have preferred that I worked in a hamburger restaurant or candy store rather than writing a book without pictures...

...my Alice, who arrived during the final stage of this process, as a carrier of love and kept me at a healthy distance from it all.

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I am convinced that learning is always beneficial, although the learning process can be quite demanding at times. But I must say: it was worth it!



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## **APPENDICES:**

***Appendix 1:*** Net of terminals for intermodal road-rail transport

***Appendix 2:*** Interview guide used in explorative interview study  
(semi-structured)

***Appendix 3:*** Cover letter and survey questionnaire (in Swedish)

***Appendix 4:*** Survey question 24 for factor analysis (in English)

***Appendix 5:*** Survey results on priorities per stratum, on-time deliveries  
and damaged goods

***Appendix 6:*** Additional gap analysis of environmental measures  
(Wilcoxon Signed Rank Test)

***Appendix 7:*** Specification of shippers' requirements per stratum



# PART 1: FOUNDATION OF THESIS

## 1 Introduction

---

An obvious trend today is increased freight transports within the European Union; especially those on road while rail transports have a stable, smaller share of the transport market. This relation between modes of transports holds true for Sweden as well, even though rail has a larger share than for the rest of the European Union. Increased road transports have negative effects on the environment, which may obstruct a sustainable development. Moving more freight off the roads and by rail instead, is desirable from an environmental point-of-view.

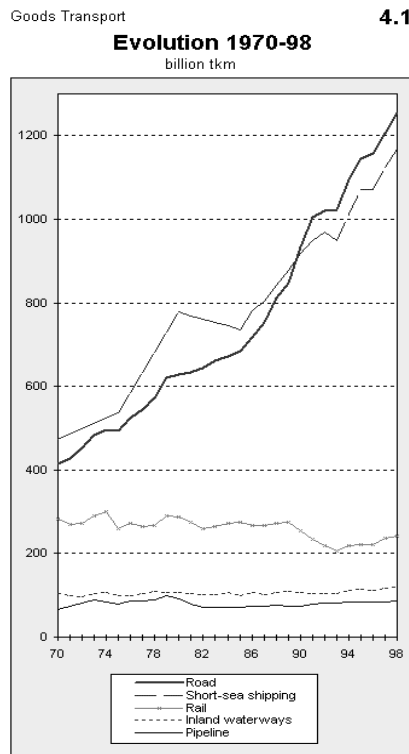
Intermodal road-rail transports using detachable load-carriers such as swapbodies, containers, trailers and articulated road vehicles, is a transport mode that, so far, has realized market-shares, which are far from the expected ones and low in comparison to direct door-to-door transport on road. This is the case within the European Union, where increased intermodal road-rail transports are considered an opportunity for relieving the pressure on road traffic. Realized market shares are far from those stipulated by the transport policy objectives.

This thesis project was initiated in year 2000, and formed part of a major thematic research program “Systems for Combined Transport between Road and Rail”, with the purpose of investigating the potentials of Swedish intermodal road-rail transports. The main purpose of this thesis is to explore the potential of using environmental arguments in the marketing of these freight transports. The research program was funded by the Swedish Agency for Innovation Systems (VINNOVA), the Swedish National Rail Administration (Banverket), the Swedish National Road Administration (Vägverket) and the Logistics and Transport Society (LTS). The program included research conducted at the Logistics and Transport Research Group at the School of Business, Economics and Law at Göteborg University, but also at the Division of Logistics and Transportation at Chalmers University of Technology in Göteborg, Sweden.

Freight transports are a vital factor for economic development in a society today. Not only must they be efficient in terms of time and space, they must also meet the growing environmental demands that are placed on them. Environmental pressures in society regarding freight transports and environmental loads form part of the company's environment. The key issue is how the companies form their strategies and act in response to those demands. Through their actions, they may work in a proactive way and influence the market and society in general. Hopefully, this thesis will contribute to understanding the actions companies take when faced with environmental issues regarding their freight transports.

## 1.1 Freight transports and the environment

The transport buying companies, the shippers, constitute the demand for freight transports and are therefore also a vital part of society. The increased freight transports in the European Union are illustrated in Figure 1.1 (European Commission 2000).



**Figure 1.1 The evolution of freight transports by transport modes within the EU 1979-1998**

The growth rate is particularly strong regarding freight transports on road, while rail transports are on a stable, much lower level. The development in Sweden is similar to the rest of Europe as the freight transports on road have gained an increasing share of the market during the last decades and dominate among the modes of transports. In 2000, for the European Union as a whole, 74% of all inland transport was performed by road where as 14% was by rail when measured in ton kilometers (European Commission 2003).

In Sweden, the total freight transport performance has increased by 24% since 1975 (SIKA 2004). Trucks on road have the fastest growth rate in terms of freight transport. A forecast for freight transport performance from the Swedish Institute for Transport and Communications Analysis (SIKA) showed that the share of trucks on road is expected to increase from 42% in 1997 to around 46% by the year 2010 (measured in ton kilometers) (SIKA 2000b). At the same time, the shares of other transport modes are expected to decrease slightly e.g. the share of rail is expected to decrease from around 22% to 20%. The Swedish freight transports are stable; the freight transport that initially took place by train or ship continues to do so to a great extent, where as the new and expanding transport flows take place mainly by truck and air (SIKA 2004). Thus, the relative importance of rail and sea transport decline over time.

It is notable that intermodal road-rail transports have not followed the development that was hoped for in the end of the 80's. In 1988, intermodal road-rail transports in Sweden transported 3.5 million tons of freight. The goal, according to the transport political decision the same year, was to reach 10 million tons by the year 2000 (Kommunikationsdepartementet 1988), but in reality it only reached 4.8 million tons in 1999 (SIKA/Banverket 2001). That corresponds to an increase of 37%, but is still less than planned. The vision was far from reality. Research has shown that there are possibilities for intermodal road-rail transports becoming competitive in Sweden (Jensen 1990).

An increase in transports can be seen as a positive expression of economic growth as well as increased welfare (SIKA 2000c), but unfortunately there are also less positive consequences. The direct environmental, negative effects of increased freight transports are among others, increased congestion and accidents. The emissions of air pollutants have decreased due to technical improvements of vehicles, boats and fuels, which have resulted in fewer emissions of sulphurs, nitric oxide and hydrocarbon (SIKA 2000c). A major problem from an environmental point-of-view is the indirect effects in terms of global warming due to increased emissions of greenhouse gases, where the carbon dioxide accounts for the major part. In 1998, carbon dioxide constituted 80% of the total

emissions of greenhouse gases in Sweden, when counted in equivalents of carbon dioxide, and the transport sector represented a 30% of the emissions of greenhouse gases (Miljömålskommittén 2000).

### **1.1.1 Politics for the environment**

In many political declarations and guidelines, sustainable development is the key concept for a desired development in the transport sector. It was defined in the so-called Brundtland Report as “the development that meets the need of the present without compromising the ability of future generations to meet their own needs” (WCED 1987). The concept is often used when speaking in environmental terms, but it is more adequate with a broader interpretation in terms of a balanced (co-evolutionary) industrial, social, ecological and economic development (Nijkamp 1994). Sustainable development is closely linked to sustainability. Hopwood et al (2005) map out three broad views based on the necessary changes in society for sustainability, based originally on Rees (1995): status quo (achieved within the present structures), reform (fundamental reform is necessary but without full rupture with the existing arrangements) or transformation (a radical transformation is needed as the roots of the problems are the economic and power structures). In the status quo view, the existing governmental and commercial systems can be pushed towards improvements with use of management techniques, e.g. Environmental Management Systems, but also with technical economic tools, e.g. trading permits. The measures for environmental improvement analyzed in this thesis can mainly be positioned within this view, as the focus is on environmental work in Swedish companies with emphasis on freight transports.

The European Union has stated that continued growth in traffic is not compatible with sustainable development and that the transport sector must decrease emissions of greenhouse gases. The European transport policy for 2010 (European Commission 2001), referred to as the White paper, stated that the European Union must decide between *status quo* (that will result in an increase in congestion and pollution and will ultimately threaten the competitiveness of Europe’s economy) or implementation of new forms of regulation (to channel future demand for mobility and to ensure that the whole of Europe’s economy develops in a sustainable fashion). To support the package of proposals to be implemented by 2010 (which are essential but not sufficient towards meeting the need for sustainable development), the White Paper stressed; the risk of congestion on the major arteries and regional imbalance, the conditions for shifting the balance between modes (e.g. to transport more freight on rail), the priority to be given to clearing bottlenecks, the new place given to users at the

heart of transport policy and the need to manage the effects of transport globalization.

In Sweden, the overall objective for transport policy is to “secure socially, economically efficient and long-term sustainable transport resources for the public and industry throughout Sweden” (Kommunikationsdepartementet 1998). Yet the Swedish National Road Administration verifies that improvements have been made but the present system is not to be regarded as sustainable (SIKA 2000c). The problems mentioned in the report are especially related to one of the five sub-goals of the Government’s transport political goals; “a good environment”. A later follow-up report concluded that the long-term goals concerning e.g. climate change (CO<sub>2</sub>), emissions (SO<sub>2</sub>, NO<sub>x</sub>, VOC) and noise of traffic will not be met unless measures are taken (SIKA 2006b). Another example is air quality which is an on-going problem for many densely populated areas. Other problems related to road traffic do not have long-term goals specified, but still affect the environment. Huge amounts of natural resources and energy are consumed in the production and maintenance of vehicles and roads (SIKA 2000c). Furthermore, the esthetical, cultural and natural environmental aspects of the landscape are affected by the existence of roads.

A goal established by the Swedish government is that the emissions of carbon dioxide from transports should be stabilized at the same level as in 1990 by year 2010. A follow-up report of the transport political goals in year 2000 stated that this goal will not be complied if certain measures are not taken (SIKA 2006b). Yet, these goals are not as far-reaching as those specified in the Kyoto protocol of 1997 ratified by Sweden. According to this protocol, the European Union members shall reduce their greenhouse emissions by 8% compared to 1990 by 2008-2012. The Swedish government has announced a target of a 2% reduction from 1990 to 2010. The Swedish Society for Nature Preservation wanted to take it a step further and set the goal for year 2010 to a decrease by 15 % (Axelsson 2000). In reality, the total emissions of greenhouse gases have increased by 1.6% between 1990 and 1999, and the increase of carbon dioxide emissions was 2.5%. The latter are calculated to reach about 10% by 2010 in Sweden. Sweden has reported to the UN climate convention that the increase is mainly caused by the transport sector (Naturvårdsverket 2002). An evaluation of the Swedish climate goals have recently been done (Miljö- och samhällsbyggnadsdepartementet 2006), since critics have regarded them as insufficient and stricter ones had been proposed (Miljömålskommittén 2000). In this, the Government aims at a reduction of greenhouse gases with 25% by year 2020 compared to 1990, and that the average reduction should be at least 4% for the period 2008-2012.

Environmental loads and consequences cause problems for society and many times on a global basis. Regulation of activities connected to environmental damage can differ from country to country but in general, public policy issues are important from a research point-of-view (mainly within the field of economics and its sub-field environmental economics) and they are also applied in society. This is first of all due to the fact that the environment is a public good<sup>1</sup> and one consequence is that the free rider problem<sup>2</sup> arises. One example of a public policy is the “polluter pays principle”<sup>3</sup>. Others can be taxes and fees for carbon dioxide emissions for example. The State gets involved and regulates for the common good. There are often distribution and equality aspects involved when public policy instruments are discussed.

In a widely cited study (INFRAS/IWW 2000), the external costs<sup>4</sup> of transport in 17 European countries, excluding congestion, were estimated to 530 billion Euros. This figure included both passenger and freight transports, and 92% of these external costs could be attributed to road alone. Congestion is a major problem in continental Europe, but it is becoming a reality in Sweden too. Transport service companies already have problems with congestion especially in the Stockholm region (Nilsson 2001), which results in time delays and inefficiency and therefore also in high costs. The costs to society are even higher because of the additional external costs. The creation of a sustainable transport system is in the interest of many; e.g. politicians, companies and the public.

### **1.1.2 Business logistics and the environment**

The environment can be viewed from three perspectives: the resource, the society and the company perspective (Dobers and Wolff 1995). In the third perspective, the changed competitive situation along with increased demands for measures for environmental protection, force the company to take an active stand. This can be turned into a strategic advantage; on one hand satisfying environmentally conscious customers and increasing demand for environmental technology, and on the other hand ensuring that businesses adapt to environmental

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<sup>1</sup> Once the goods are made available to one person, they can be consumed by others at no additional marginal cost (Hardin 2007).

<sup>2</sup> All individual members of a group can benefit from the efforts of each member and all can benefit substantially from collective action. A *freerider* benefits without contributing to the collective effort i.e. to the collective good (Hardin 2007).

<sup>3</sup> The principle states that those causing pollution should meet the costs to which it gives rise, according to the definition of the European Environment Agency (EEA 2007).

<sup>4</sup> An external cost is a cost not included in the market price of the goods and services being produced, i.e. a cost not borne by those who create it (EEA 2007).

considerations. These perspectives can be applied on freight transports. From a resource perspective, the transport sector uses oil as the main source of fuel, which produces emissions of carbon dioxide. This contributes to the greenhouse effect for which there is no technical solution. This increases problems from society's perspective and legislation is a possible tool, but companies also work proactively, since legislation can reduce their degrees of freedom.

In business relations, the selling company usually purchases the transport to the customer and this task is executed by the logistics manager or equivalent. Wu and Dunn (1995) showed in a model based on the value chain by Porter (1985), how logistics decisions interact with other business functions and concluded that logistics managers play a critical role in a company's environmental management program because their decisions have a direct impact on the environment e.g. choice of transport mode. This will be discussed in Section 2.3.1.

Three ways of diminishing the environmental impact of the transports are (Björklund 2005; Pilo 1997):

- Diminishing the need for transports.
- Increasing use of environmentally better modes of transport, e.g. from truck to electrified railway.
- Minimizing the environmental impact of every mode of transport, e.g. better fuels, technology, maintenance, knowledge, speed limits, vehicle design.

Diminishing the need for transports includes organizational and logistics changes such as increasing the load factor of existing modes of transports used by e.g. coordinate transport flows. Naturally, it also involves the long-term perspective, including structural changes e.g. localization of industries. There is, of course, also the possibility of combining these methods. In this thesis, emphasis will be on the use of environmentally better modes of transport, which in turn highlights the modal choice in combination with the environmental considerations of freight transports among shippers.

In most cases, rail can be considered a better alternative from an environmental point-of-view than truck for freight transports, even if the production of energy is taken into account. A share of 95% of the total transport work on rail in Sweden use electricity and the rest diesel (NTM 2005). The former monopoly company on rail (SJ), today renamed Green Cargo and one of the largest freight forwarders on rail in Sweden, uses eco-labeled electricity "Good Environmental

Choice”<sup>5</sup>. Intermodal road-rail transports are an alternative to direct door-to-door rail transports, if the company does not have own railway sidings. In the discussion of intermodal road-rail transports the underlying assumption in the conducted research is that these transports have an advantage from an environmental point-of-view compared to road transports. This is also discussed in Section 3.3. The direct environmental benefits are fewer accidents on road, congestion, air pollution, climate change, noise and other environmental side effects such as impact on nature and landscape.

The planet is experiencing a time of population and economic growth while at the same time, it is limited in its ability to supply resources and to absorb the wastes (Stead and Stead 1996). The environmental problems are air and water pollution, climate change, waste-disposal problems, acid rain, and species loss. Changes are needed in many ways, but the major one might be the economic paradigm, and the important role of business leaders cannot be underestimated since they represent the largest group of economic decision-makers (Stead and Stead 1996). Other pressure groups are politicians in the European Union and Sweden, environmental organizations, freight forwarders and shippers. Their influence may lead to political decisions that will affect companies having freight transports, but also attitudes among the interested parties in the company’s environment. According to stakeholder theory (Freeman 1984), stakeholders are present both internally and externally of a company. Companies that have the capability to focus on a more efficient integration, both internally and externally, will probably be more successful than those who only concentrate on internal development (Normann and Ramírez 1994).

In Swedish companies, it is becoming more and more common to use a questionnaire in dealing with several environmental aspects when transports are purchased. An example where companies, researchers and other organizations interested in transports and environmental issues co-operate is the organization NTM (the Network for Transport and the Environment) in Sweden. This has several workgroups and one has developed a tool which supports transport buyers in companies when they make environmental evaluations of transport providers (NTM 2005). The organization has also calculated environmental loads of different transport modes to help their members.

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<sup>5</sup> In Sweden, the organisation SSNC delivers an independent labelling scheme (SNF 2007) and places requirements on e.g. the use of non-renewable energy, manufacturing and distribution of energy driving a vehicle, correct disposal when a vehicle is scrapped.



## 1.2 Intermodal road-rail freight transports: An overview

The modes of transport that are considered better from an environmental point-of-view includes rail. If the goal is to find a door-to-door transport solution, then the rail option requires railway sidings in both ends of the transport i.e. the freight customers must have their own tracks. The other alternative is an intermodal road-rail transport.

There is sometimes confusion between similar terms such as multimodal transport, intermodal transport and combined transport. In Europe, common terminology has been elaborated by three intergovernmental organizations: the European Union (EU), the European Conference of Ministers of Transport (ECMT) and the Economic Commission for Europe of the United Nations (UN/ECE). Their definitions will be used in this thesis.

The more general term *multimodal transport* refers to the carriage of goods by two or more modes of transport. Stricter is the definition of an *intermodal transport* which is:

“The movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes.” (UN/ECE 2001)

Note also that the term *intermodality* has been used to describe:

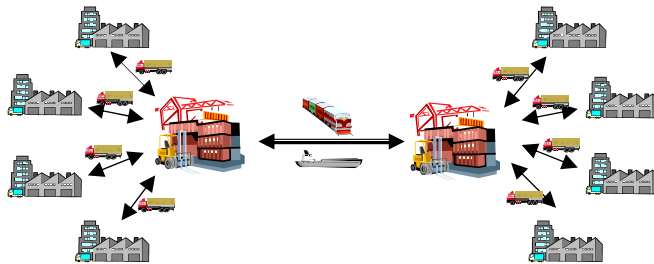
“a system of transport whereby two or more modes of transport are used to transport the same loading unit or truck in an integrated manner, without loading or unloading, in a [door-to-door] transport chain”.(UN/ECE 2001)

Finally a *combined transport* is defined as

“an intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are as short as possible”. (UN/ECE 2001)

In sum, the central for a combined road-rail transport is that the freight is loaded onto a load carrier at the point of origin and is hauled on the carrier to the destination point, where it is unloaded. The carrier is transferred at least once from one mode of transport to another between the point of origin and point of destination (Jensen 1990) and thus, it is vital to use interchangeable load carriers that can be used in different modes of transports. In this thesis, it would be possible to use the term combined transport, but it is more common to use the term in-

termodal transport in an international setting. Therefore, the term intermodal road-rail transport will be used, according to its definition and also the definition of intermodality. A truck, a load carrier, a railway truck and a reloading system are needed in order to put through an intermodal road-rail transport. There are various types of carriers, but the most common ones are semi-trailers, swap-bodies and containers. The intermodal road-rail transport system is illustrated in Figure 1.2 (Flodén 2003).



**Figure 1.2 The intermodal road-rail transport system**

The reloading system consists of an intermodal road-rail transports terminal, at least in a large scale in the classic intermodal road-rail transport system. There have been smaller projects in the light intermodal road-rail transports field though, where a large intermodal terminal is not needed to load and unload the rail wagon, and therefore the high fixed terminal costs can be reduced. On the other hand, the low variable haulage costs of the railway are an advantage on the cost side in favor for large-scale transport of heavy freight over long distances. In the case of road transports, they offer accessibility with maintained economy for smaller shipments over small distances. The disadvantages are mainly on the environmental effects side such as air pollution, congestion and other external effects. A combination of rail and road is a way of maintaining flexibility yet decreasing the external effects. (Woxenius 1998)

### ***1.2.1 The Swedish intermodal road-rail transport system***

As a result of the deregulation in 1996, all freight transport on rail in Sweden is today under competition. The infrastructure of the railways though is under the state-owned Swedish National Rail Administration (Banverket). The railway deregulation has separated the infrastructure and transports on rail organizationally, which is a prerequisite of competition on rail. In this way, the sunk costs of infrastructure investments are not put on the actors producing rail transports, but on the State. The pure rail freight transports (without the terminal handling of intermodal road-rail transports) used to be performed by SJ Cargo, but when the

Swedish state railways unbundled into six different companies, the freight section SJ Cargo Group became Green Cargo.

The production of intermodal road-rail transports (terminal handling and railway service) in Sweden is mainly performed by CargoNet, known as Rail Combi before 2005. Rail Combi was a subsidiary of Green Cargo before CargoNet entered in 2002, and then became a subsidiary of the Norwegian CargoNet AS, formerly state-owned NSB Gods (Railcombi 2003). CargoNet is 55% owned by the NSB and 45% by Green Cargo. The total number of intermodal road-rail terminals in Sweden and Norway is 26, of which 16 are placed at 14 locations in Sweden, and the company also has collaborative partners in other countries (see Appendix 1). It carries whole unit loads from 20-foot containers and up on regularly scheduled shuttle trains for intermodal traffic and offers services e.g. collection and delivery (CargoNet 2006). CargoNet acts as a subcontractor for road carriers, forwarders and shipping agents, which sell the complete door-to-door service to the shippers. A door-to-door transport includes pick-up by truck, terminal handling, railway transport and distribution by truck. The transport companies contracting CargoNet can also choose to use long-distance road haulage, either produced in-house or bought on the market where competition in the supply is tough. So, the competition from road haulage is very significant (Jensen 1998).

Swahn (1998) has identified factors that may impede the development of profitable intermodal transport solutions: less control of production process and customer relations (as many links/actors are involved), high costs together with low productivity in certain production systems (e.g. intermodal rail terminals), uncertainty of the results of major structural changes due to European integration (e.g. partners may disappear) and uncertainty of future international rules (e.g. the rail deregulation process within the EU). The last consideration especially affects Swedish companies that transport freight to and/or from Sweden. Therefore there will be a brief overview of the rail situation in Europe next.

### ***1.2.2 Rail and intermodal road-rail transports in the European Union***

Rail has a small share of the transport market in Europe in comparison to truck transports in particular. It has decreased by 50% over the past 25 years, at the same time the total freight transport market has increased by almost 75%, and the whole increase has gone to truck transports (Nelldal 2005). In examining rail networks in Europe it is evident that there is not a European rail network, but individual countries networks, which is a disadvantage to rail compared to

truck hauling. International rail shipments in Europe are affected by operational conditions, level of service and management attitude on individual countries rail network and it is problematic to provide a reliable and flexible service (Nijkamp et al. 1994). The truck in contrast offers a door-to-door service and is not affected by such adversities. These problems can raise the cost components of freight transport that users need to bear: direct monetary tariffs, costs due to time and to uncertainty. An illustration is the case of IKEA. In order to reach the goal of transporting 40% of all their freight on rail by 2006 (the share was 20% in 2001), the company started IKEA Rail AB (Hellbom 2001). This was the first private non-transport company in Europe to start with their own intermodal road-rail operations. Their initial experiences have showed that there exist both administrative barriers of entry, as well as technological barriers of entry in order to make these transports efficient (Beijbom 2002).

The EU White Paper addresses similar problems that must be solved since they hold back the development of the railway in Europe. Such problems are for example; lack of infrastructure suitable for modern transport, interoperability between networks and systems, the constant search for innovative manufacturing technologies, the non-transparency of costs, the uneven productivity and reliability of the service (which is failing to meet customer expectations). If nothing is done to solve these problems, rail's share of the freight transport market, which has already fallen from 11% in 1990 to 8% in 1998, can be expected to slip to 7% by 2010 (European Commission 2001). There is a common strategy for the creation of a single European railway system by 2020<sup>6</sup> and some of the five objectives for 2020 were: increase rail's market share of freight traffic from 8% to 15%, a 50% gain in energy efficiency, and a 50% reduction in emissions of pollutants (European Commission 2001). In sum, an increased share of intermodal road-rail transports is a political goal in Sweden, as well as in the rest of the European Union. So far, this has not become a reality. If this goal can be reached, it would benefit the environment and consequently society.

### **1.3 Market situation for intermodal road-rail transports in Sweden**

The shares of freight transported by rail as transport mode have been on a stable level, as discussed in Section 1.1. The competitiveness of the railroad deterior-

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<sup>6</sup> It was signed by the International Union of Railways (UIR), the Community of European Railways (CER), the International Union of Public Transport (IUPT) and the Union of European Railway Industries (UNIFE).

rated in the beginning of the 1990's, for both wagonload<sup>7</sup> and intermodal road-rail transports, when the limits of axle loads for trucks in Sweden were raised<sup>8</sup> (Ahlstedt and Nelldal 2002). Measured in ton kilometers, wagonload traffic accounts for 40% of all freight transported by rail in Sweden, unit trains<sup>9</sup> for 28%, and intermodal road-rail traffic for 12% (Nelldal 2005). The northern ore line, which is also a unit train, accounts for 20%. In an international comparison, Sweden's railway has a market share twice as large as the railways in the rest of Europe, in terms of productivity (Nelldal 2005). It is worth mentioning that Sweden has the largest trucks, since Sweden along with Finland are exempted from the rules in the European Union of maximum truck length<sup>10</sup> (Näringsdepartementet 2006). The railways' market share of international transport is only half of that for domestic haulage, despite long distances and large freight volumes (Nelldal 2005). Some of the problems with international rail transports in Europe were discussed above in Section 1.2.2.

The intermodal transports have not been sufficiently attractive for transport buyers in comparison to other transport alternatives on the market, but it has been a positive development during the past few years (Näringsdepartementet 2006). The production development of intermodal transports, reported by formerly Railcombi, shows a positive trend where the volumes have increased by about 60% between the years 1993 and 2003 (Godstransportdelegationen 2002). What has been done historically to increase the market shares of intermodal road-rail transports?

Historically, there have been traffic political decisions in Sweden with great expectations of a positive development of intermodal road-rail transports e.g. it was pointed out in a rail political decision from 1985 that it was important that the transport industry understood the political will to give the State-owned rail company SJ possibilities to provide capacity, technique and service to secure the long-term needs. Therefore, the Transport committee proposed that these transports should be supported in transport politics during the rest of 1980's and during 1990's (Kommunikationsdepartementet 1985; Trafikutskottet 1985). However, the development that followed did not reach the targets set despite

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<sup>7</sup> Using whole wagons that are loaded and unloaded by the customer at industrial sidings or loading platforms

<sup>8</sup> The increased limits meant that the total weight increased from 51.4 to 60 tons, and the loading weight from about 32 to 40 tons.

<sup>9</sup> Complete trains operated for a specific customer with dedicated wagons and according to their own timetable.

<sup>10</sup> In the EU, a truck may weight 40 tons and the maximum length is 18.75 meters. In Sweden and Finland, the maximum length is 25.25 meters and weight 60 tons.

certain pilot projects e.g. intermodal road-rail transports using piggy-backs between Strömstad and Trelleborg where entire trailers were transported on trains. However, the aspiration for a positive development of intermodal road-rail transports remained a decade later, in particular due to environmental motivations (Trafikutskottet 1998).

Before going into marketing efforts regarding intermodal freight transports, the best starting point must be an external analysis of the market today and potentials for the future. This was partly done in the transport political proposition *Modern Transports* from the Swedish government (Näringsdepartementet 2006), with analysis mainly from an earlier report from a special committee with representatives from the transport market i.e. shippers, transport providers etc. (Godstransportdelegationen 2002). Their assignment was to propose measures for the Swedish government to carry through in order to promote cooperation between different modes of transports in order to attain a sustainable transport system. Their suggestions have been guiding political incentives proposed for intermodal transports. A number of trends in favor of intermodal transports were identified:

- an *increased and more concentrated transport work*: due to increased amounts of freight transported and increased transport distances
- an *increased environmental profile*: among customers affects the choice of transport mode
- increased share of freight transported in a single loading unit<sup>11</sup>
- *the structural changes of the logistics industry*: consolidation of companies has led to a number of large European transport companies offering combinations of transport modes
- *larger vehicles and carriers*: in rail and sea, especially since there is a discussion of increasing the size limits
- *political initiatives*: many European countries invest a lot of money in order to develop intermodal transports involving rail and sea, e.g. in terminals.

In order to illustrate the increased share of freight volumes transported in a single loading unit, it is possible to examine the share of intermodal rail traffic within Sweden and going abroad. The domestic freight increased from 32,476,000 metric tons in 1997 to 34,795,000 metric tons in 2001, where the share of freight transported in a single loading units constituted 10.2% in 1997

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<sup>11</sup> These units can be ITU (Intermodal Transport Unit) i.e. container, swap-bodies or trailers. The capacity is often measured in twenty-foot equivalent units (TEU) and is equal to 6.10 m (length) × 2.44 m (width) × 2.59 m (height), or approximately 39 m<sup>3</sup>.

and 11.7% in 2001. The corresponding shares of freight going abroad decreased from 24,255,000 to 20,411,000 metric tons, and from 4.7% to 4.1% (Godstransportdelegationen 2002).

In order to get a grip of the total freight transport market, it is useful to study the latest statistics on the estimated total freight movements in Sweden presented in the Commodity flow survey 2004/2005<sup>12</sup> (SIKA 2006a). These figures show that the outgoing shipments in 2004/2005 amounted to a total of SEK 2,093 billion worth of goods with a total weight of 282 million tons. Road transport accounted for 68% of the outgoing shipments in weight terms (60% in value terms) and railway transport -or railway combined with other transport modes- accounted for 12% in weight terms (5% in value terms). The incoming shipments from abroad is estimated to SEK 526 billion in value terms and 67 million tons in weight terms. These were mainly by sea (65% in weight terms and 22% in value terms), but sea and road combined accounted for 20% in weight terms (44% in value terms) and road transport as a single mode accounted for 11% (23% in value terms).

These recent statistics show that road transports dominate and in particular regarding the outgoing transports from Sweden. This implies that the choice of truck as the dominant transport mode to use for freight movements is often made by the Swedish shippers, which is interesting for the purpose of this thesis. In a forecast for freight transports from 2001 through to 2020 (SIKA 2005), freight flows are expected to grow by 21% (about 21 billion ton kilometers) and the freight flows to, from and through Sweden are expected to grow more rapidly than flows of domestic freight transport. Growth on road is expected to increase by 31%, on railways by 16% and by sea by 12%, according to a calculated scenario.

There are also a few trends that impede the growth of intermodal transports (Godstransportdelegationen 2002). The value of the freight transported is increasing (with higher demands on transport time, reliability, flexibility and few damages), augmented shares of direct distribution along with smaller shipments, more complex logistics systems along with increasing customer demands (on fast response and flexibility), and finally shortcomings in planning of society (e.g. location of intermodal terminals). All these trends will favor road transports, or in some cases air, rather than intermodal transports.

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<sup>12</sup> The period of measurement of VFU04/05 is the second half of 2004 and first half of 2005. The previous national commodity survey was in 2001.

There are also other obstacles for intermodal transports identified by the special committee mentioned above (Godstransportdelegationen 2002), mainly administrative and economic ones and less important are the pure technical ones (e.g. the lower loading capacity compared to the alternatives). The administrative ones are lack of standards, distribution of capacity on the railway network, responsibility issues and security. Economic obstacles mentioned are e.g. high initial costs in the development and market introduction of new intermodal transport solutions. The Committee proposes an identification of strategically important intermodal terminals and that the State may finance some of the terminal costs in order to stimulate intermodal transports, which was later supported by the Government in the proposition *Modern Transports* (Näringsdepartementet 2006). It is also stated in this proposition that an aim is to introduce a kilometer tax for commercial vehicles although an analysis of the consequences will be conducted firstly. It has been acknowledged in previous research (Jensen 1990) that this traffic-political control may influence a switch to intermodal road-rail transports as the haulers' costs for their route-based long-haul road transport will increase and there will therefore be a cost savings potential from this switch. Only the future will tell whether the trend of increased market shares for intermodal road-rail transports will continue and at what pace. Public policy incentives may have an influence as well as market initiatives from actors in the intermodal chain.

It is not only on the political arena that changes occur due to increased attention for environmental aspects of transportation. Companies want to work actively with environmental issues in their business and many want to be perceived as environmentally conscious companies. Companies have reached different levels of advancement in these issues depending on business, knowledge and organizational culture. Many companies have experienced increased attention to their environmental work in their every-day business in the form of more inquiries from customers, as in the case of one transport service provider.<sup>13</sup> Those inquiries concerned whether or not the company had an environmental policy, if environmental audits were conducted, if environmental demands are put on suppliers and so on. In short, more companies pay attention to the environmental consequences of their business, including their transports.

It can be concluded that an increase in intermodal road-rail transports has been acknowledged from society as political desirable since the mid-80's, but with a

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<sup>13</sup> As an example, the large logistics provider Schenker got an increase from 137 inquiries during 1997 to more than 300 during the first nine months of 1999 in Sweden (Trouvé 2000).



more intense interest during the last decade due to negative environmental effects from growing freight flows. “A good environment” was accepted as one of five transport political goals in 1998 (Kommunikationsdepartementet 1998). The intermodal flows have had a stable development, increasing but at a slow pace. The proposed measures in order to increase the intermodal shares (Godstransportdelegationen 2002; Näringsdepartementet 2006) pinpoint economic stimuli from the State e.g. a kilometer tax for commercial vehicles and to finance intermodal terminal costs. However, there seem to be unused opportunities, based on the demand for freight transports, by using marketing efforts both from society and from actors in the intermodal chain. There are several aspects that can be highlighted as advantages in the marketing of intermodal transports, but one of the most obvious is the low level of negative environmental effects compared to road transports. The increased environmental consciousness among companies may make purchasers of transports at the shippers more open for environmentally preferable transport services, and thus intermodal road-rail transports.

#### **1.4 Research problem and purpose**

Society would benefit from increased freight transports on rail, or intermodal road-rail transports, and in that way decrease the negative environmental effects by cutting down the share of good transports on road. At the same time, there are indications on increased demands on companies to work towards tuning its activities in a more environmental direction. Environmental issues have become an important ingredient in a company’s over-all strategy and have now been present for the last decades, especially since the early 90’s. Environmental considerations regarding freight transports are part of the environmental strategy. A key process of influence is the transport buying process at the shippers.

The development of intermodal road-rail transports has been slower than expected, even if the volumes have been increasing during the last few years. In the analyses conducted of these transports, both from an industrial and from a political point-of-view, the focus has been on the barriers and opportunities from a mainly technological view. However, marketing may be used to change buying behavior among shippers and transport providers. A stimulated demand may have an influence on e.g. planning of infrastructure or rail slots. Successful marketing in a market economy can be based, among other things, on the seller emphasizing and promoting product characteristics that differ from competitors’ alternatives i.e. that the seller aims at product differentiation. The environmental aspect is a quality that intermodal road-rail transports may capitalize on in order to develop marketing strategies based on differentiation and to use these strate-

gies in competition with direct transport on road. The environmental aspect is at least a dimension where intermodal road-rail transports may have a competitive advantage. This potential competitive advantage from a marketing perspective is an opportunity to increase the share of intermodal road-rail transports in Sweden. This is a central issue in this thesis.

The **purpose** of this thesis is:

*To explore the potential of using environmental arguments in the marketing of intermodal road-rail freight transports.*

Marketing is commonly considered as a way of selling a product or service by a company. However, the scope of this thesis is broader in that marketing efforts may not only be used by transportation companies selling freight transports. There are several other actors in society that could be involved with the interest of reducing road transports in favor of increased intermodal road-rail transports e.g. local authorities wanting to reduce the regional negative environmental effects or national governmental bodies and non-governmental organizations aiming at a more sustainable transport system. The potential actors will be discussed later, see Section 3.3. In order to use a marketing approach by the various interested actors, a market analysis of the freight transport market is needed focusing especially on the freight customers. This is the scope of this thesis.

The main purpose forms a base to guide the research process, but in order to conduct the study, the formulation of more precise research questions are needed. Before that, theory may offer contributions, so the research questions are discussed in Chapter 3 after the theoretical framework in Chapter 2. At the end of Chapter 1, there is also an overview of the structure of chapters which may facilitate the understanding of the structure of this thesis.

## **1.5 Delimitations**

The environment is of interest to the society as a whole and public policy issues are important. Companies are affected by changes in their business environment and can at the same time try to influence public policy. This thesis will however not put emphasis on designing public policy tools. Transportation decisions within a company are affected by external factors e.g. the state of the infrastructure or road tolls. Companies have limited power over these factors, but take them into consideration in their decision-making as restraints. The main emphasis in this thesis is instead on the demand side of freight transports, i.e. the companies purchasing them, the shippers, and their decisions.

Intermodal road-rail transports are competing with other modes of transports, particularly freight transports by truck. Other modes of transports, e.g. air and sea are becoming more important, but they are not directly taken into account as competing modes, since the focus is on land transports. This thesis explores the demand for all freight transports but with a focus on potential freight for intermodal road-rail freight transports. This is defined in this study as; all freight that can be transported door-to-door by truck in Sweden or when it is either shipped out of or received in Sweden.

## **1.6 Possible contributions of thesis**

In this initial part of this thesis, it would not be out of place to discuss what could be the expected contribution of this work. First of all, it forms part of a major research project about intermodal road-rail transports in Sweden. The contribution to the project will be to explore what impact environmental considerations has on the demand for freight transports in companies at present and in the future, and whether there is a potential for using this knowledge in the marketing strategies of intermodal road-rail transports. This contribution will help the research project as a whole to increase our scientific knowledge of a more diversified picture of intermodal road-rail transports. Also other members of the research community of transportation along with those of environmental marketing and management will, hopefully, find the results useful.

The results may also help decision-makers in companies shipping freight in their work with environmentally preferable freight transport services, by using the results provided about the general status among Swedish shippers as benchmarks to be compared with. Perhaps this can stimulate them to make business processes and routines more efficient, both from an economic and from an environmental point-of-view, and to find underutilized business opportunities.

Finally, the results may also be useful to governmental representatives and policy makers, when looking into the trend of increased freight transports and the resulting environmental consequences. This thesis may provide a knowledge base when politicians, among others, discuss public policy tools for increasing the shares of intermodal road-rail transports in order to relieve the pressure on road transports. A sustainable transport system is an aim for policy makers, users, society, and not the least for future generations. The key question is how to reach it.

## 1.7 Structure of thesis

This first chapter of the thesis outlined the background of the research problem and led to the formulation of the main purpose. Chapter 2 will provide the theoretical framework and Chapter 3 will deepen the research problem and conclude with the formulation of a set of research questions. The methodological considerations will be discussed in Chapter 4, before the results will be presented in Chapters 5-8. In the research process, theory and empirical data have interplayed and influenced each other. This will lead to the conclusions in Chapter 9. The connection between the chapters is shown in Figure 1.3. Finally the fulfillment of research questions and contribution will be discussed in Chapter 10, and suggestions for future research in Chapter 11 (not shown in Figure 1.3).

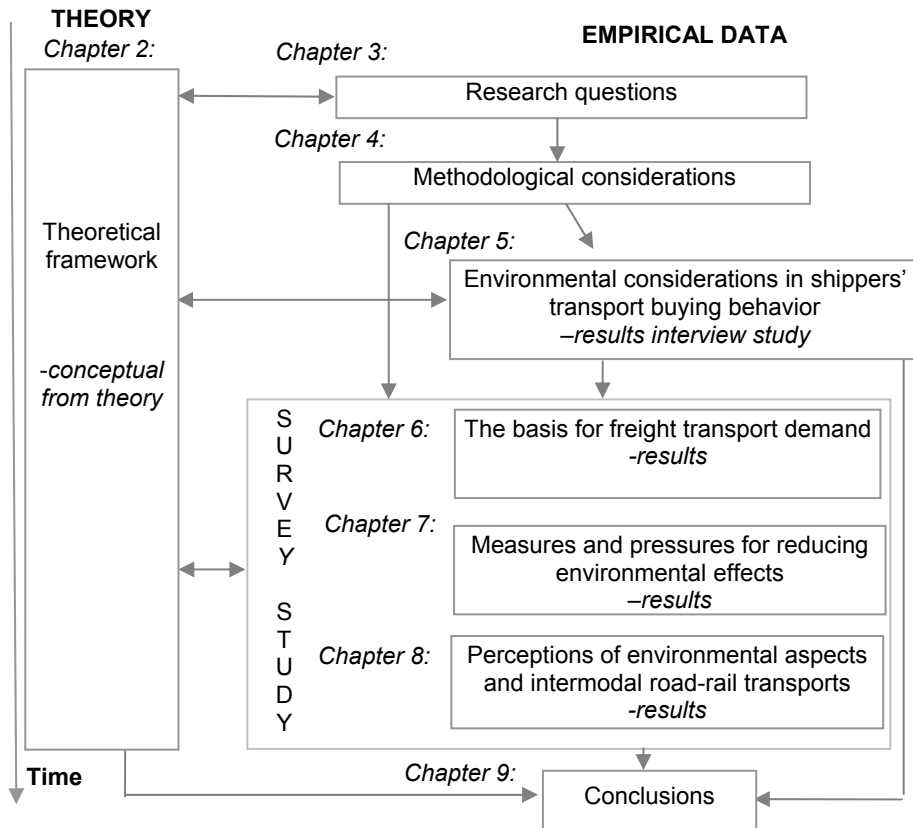


Figure 1.3 The structure of chapters in connection to the research process in time

The next chapter, Chapter 2, will provide the theoretical foundation of this thesis.

## 2 Theoretical framework

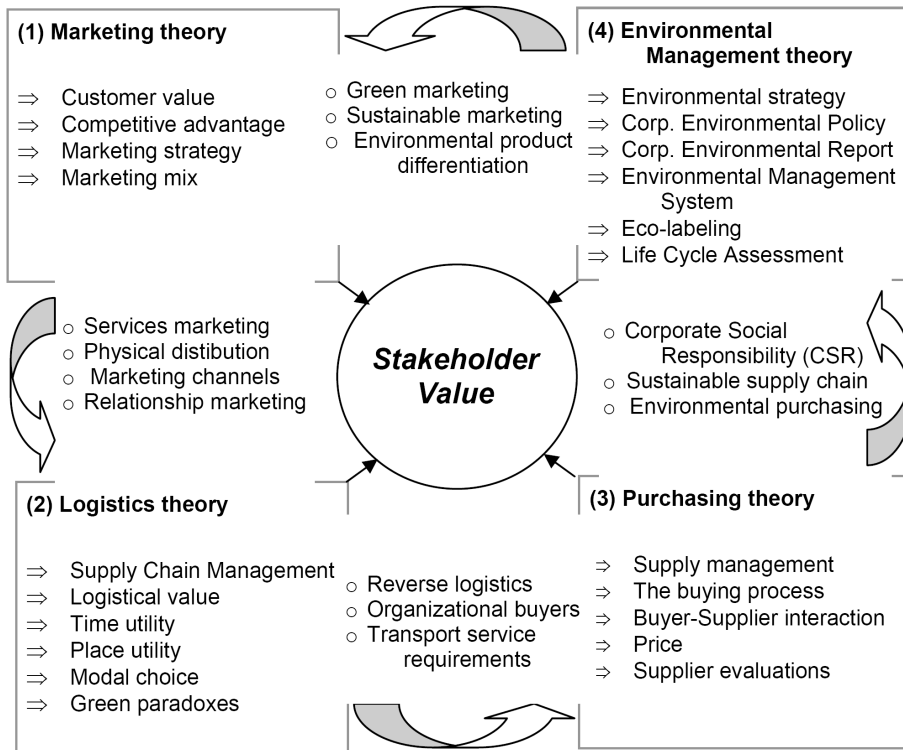
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The scope of this thesis lies in the domain of logistics theory, but due to the boundary-spanning purpose of this study, other fields of theory are highly relevant and enriching to include: mainly marketing, purchasing and environmental management. These theory fields have contributions to make for the elaboration of research questions and also for the proceeding empirical studies. This chapter builds a conceptual framework in a proposed model by combining marketing, logistics, purchasing and environmental management theory for marketing of freight transports based on environmental advantages. There is a knowledge need for a theoretical framework regarding environmental aspects in the marketing of freight transports. Finally, the findings are put together in a new, more process-focused model. This resulting conceptual model is also tested further on in the thesis when the empirical results are presented and the terminology used in this model is reflected upon, especially in the conclusions in Chapter 9.

Logistics theory has become a field of research in its own right, but many concepts originate from distribution in marketing theory, which links them in the theory development. At the same time, logistics and environmental management are subjects of increased attention in society because of negative environmental consequences due to increased freight transports, especially on road. The purchasing function of freight transports plays a key role as a driver of environmental considerations, as buyers' demands are more easily met if there is purchasing power behind them. Marketing theory, including environmental marketing, can be applied on environmental aspects of logistics and transports. In line with the purpose of this thesis, transport providers that offer environmentally preferable transport services may have the opportunity to develop marketing strategies based on differentiation, targeting customers that perceive them as value-adding. Value is a core concept and therefore stakeholder value is considered the "heart" of the proposed model in the following section.

## 2.1 Proposed model of conceptual framework

The idea of the proposed model is to structure the findings in the four theory fields relevant for the purpose of this thesis. This may facilitate to see the theoretical foundation of the empirical studies conducted as a whole, and especially their interconnectivity. The proposed model has a quadratic shape with marketing, logistics, purchasing and environmental theory on each of the four sides, and the common concept is stakeholder value. The limits around the theory fields are not distinct, rather blurred, as there is research combining them in between e.g. the concept of marketing channels is positioned when moving from marketing to logistics theory. The chapter will follow the proposed model in Figure 2.1. Initially, there will be a brief discussion of the value concept, then marketing will be addressed (1), then logistics (2), purchasing (3), environmental management (4), and then back to marketing (1).



**Figure 2.1 Model of major theory developments in marketing, logistics, purchasing and environmental management, along with their interconnectivity**

Value can be considered from different perspectives and the most obvious one has to do with finances. The fundamental purpose of a business is to build financial value, i.e. to earn more than the cost of capital. It is built on the expected future cash flows, discounted at its cost of capital, resulting in a positive net present value (Mathur and Kenyon 1997). Also, if the net present value is to be boosted, the next question is of what and to what stakeholder, e.g. the shareholder, owner or investor value. The *stakeholder value* is based on the view that a company has responsibilities to many stakeholders, not just investors, including employees, customers, suppliers, society and the environment. (Mathur and Kenyon 1997). This is in accordance with the stakeholder theory (Freeman 1984) that has been applied to environmentalism in business in various studies. Fineman and Clarke (1996) identified the pressure from “green stakeholders”. Banerjee et al. (2003) identified four important antecedents to “corporate environmentalism” where environmental concerns are integrated into a company’s decision-making process: public concern, regulatory forces, competitive advantage and top management commitment. A typology of stakeholder participation for company environmental decision-making was presented by Green and Hutton-Clarke (2003). Waddock et al. (2002) found that demands for managing responsibly derive from three general sources: primary stakeholders (e.g. owners, employees, customers, suppliers); secondary stakeholders (e.g. NGOs, activists, communities, governments); and general societal trends and institutional forces. In sum, the pressures from various stakeholders force companies to take an active stand in environmental issues. This includes companies offering logistics services, which play a vital role in all supply chains.

In the case of freight transports, stakeholder groups are interested in companies performing these in a better way from an environmental point-of-view. This fact can be used in the communication strategies towards stakeholder groups, e.g. customers, politicians, representatives of interest groups. One method of communicating a company’s multiple objectives is to use the Balanced Scorecard invented by Kaplan and Norton (1996), where mission and strategy are translated into objectives in four perspectives; financial, customer, internal business process, and learning and growth. In the customer perspective, value represents the attributes that companies provide through services and products, to create loyalty and satisfaction in targeted customer segments, and also including image. Environmental aspects are attributes of a transport service that may affect the company image. However, not all customers are interested in environmentally better transports, but by identifying those who are, target groups for marketing of these transports can be defined, and environmental considerations can be used as a competitive advantage in selling freight transports. In a marketing perspective, customer value is essential.

## 2.2 Marketing theory

In marketing literature, value creation is vital as seen in this definition of marketing: “Marketing is an organizational function and a set of processes for creating, communicating, and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders” (American Marketing Association 2005). The basic logic behind value-creation is the *customer value* gained when the benefits exceed the cost. El-Ansary (2003) holds that by creating customer value, customer experience is created and at best, customer satisfaction is achieved. This occurs when the delivered performance exceeds the expected performance. In order to keep customers and create a long-term relationship with them, value is of highest importance. The ability to provide superior value to customers has become a means of differentiation and a key to finding a *competitive advantage* (Ravald and Gronroos 1996).

Porter (1985) suggests that a company can choose and implement a strategy to achieve and sustain competitive advantage and take the scope of the company’s activities into account. In his view, there are two basic types of competitive advantage that a company can have, low cost or differentiation. The basic tool proposed for diagnosing competitive advantage and finding ways to enhance it is through the value chain concept. The primary activities are the base: inbound logistics, operations, outbound logistics, marketing and sales and service in order of process in time. There are also other parallel processes along with the primary activities that form part of the value chain of a company: procurement, technology development and human resource management. The last part is the company infrastructure, although it does not belong to the activities in time. The value chain model was criticized by Wikström and Normann (1994) who argued that it is not as applicable when transactions become increasingly involved with knowledge and information, and when value creation builds on reciprocal and synchronous (rather than sequential) logic. Instead they proposed the “value star model”, where suppliers, customers, end customers, etc. contribute simultaneously to the value-creating process and the company recognizes the customer as a co-producer. For example, a customer may put forward environmental demands that affect the production of a product or service, e.g. how freight transports are performed. This is in line with the network perspective of business relations, which e.g. the interaction model (Håkansson 1982) is based upon where the core is value creation through relationships, networks and interactions which will be discussed later in Section 2.4.

If value is to be created, the first step would be to ensure knowledge in a knowledge generating system (Normann and Ramírez 1994) and for individuals to be



effective in this system will depend on various factors, e.g. their tools, their team, leadership structures but also their knowledge, attitudes, values and ethical stand points. If a selling company is going to add value to its customers, it needs to find out what the customers value. Anderson and Narus (1998) argued that many customers know their demands but not how much it is worth to fulfill them. The authors also stressed that value and price are not the same thing, but rather two elementary qualities of the market offer. Value is what the customer gets in exchange for the price she/he pays, and to raise or lower the price on the market offer does not change the value of it to the customer, rather, it changes the customer's incitement to buy the market offer. This implies that if e.g. a customer values receiving offers of transport alternatives that are better from an environmental point-of-view, it does not need to be cheaper or even have the same price. In fact, the alternative might be chosen even if the price is higher, but only if the environmental aspect of the offer is perceived as an added value.

When a company aims to add value to its offer, this is often incorporated in the strategy. Research on strategy is an own field of research and will only be dealt with briefly here but also, to some extent, later on in connection to environmental strategy, see Section 2.5. Strategic market management is a way of identifying alternatives among strategies, according to a framework by Aaker (2001). A first step is to perform an external analysis, which makes it possible to identify opportunities, threats, trends and strategic uncertainties. In addition, an internal analysis is made, which helps in identifying strategic strengths, weaknesses, problems, constraints and uncertainties. After these two analyses, the next step is to identify and select strategy which includes; the identification of strategic alternatives such as product-market investment strategies, functional area strategies and, finally, assets, competencies, and synergies. A strategy is selected, the operational plan is implemented and the strategy is to be reviewed later. It is proactive and future-oriented, and also needed since a company's constantly changing external environment brings strategic surprises and fast-developing threats and opportunities. **Marketing strategy** is a narrower concept, usually included in strategic market management and also in the planning cycle. It involves selecting and analyzing a target market and creating and maintaining a marketing mix. The **marketing mix** concept (Borden 1964) has been formulated in brief as the 4 P's in every textbook of marketing (Dibb et al. 1991; Kotler et al. 2001): Price, Product, Promotion and Place (distribution). Freight transport services help shippers with their distribution and, at the same time, the marketing of these services can emphasize the different P's in various ways. Environmental aspects of transports can be considered to be a part of the P for Product.

### 2.2.1 Combining marketing theory and logistics theory

Freight transports services are intangibles and therefore *services marketing* is an interesting sub-field to explore. Berry and Parasuranam (1991) pointed out that the four P's do not work well in services businesses without a Q for quality. Although both services marketing and goods marketing start with need-identification and product design functions, the major difference is that goods are generally produced before sold and the opposite holds true for services. Also, services marketing has less influence on customers before purchase than goods marketing, as brand preference due to packaging, promotion, pricing and distribution cannot be used. Customers must experience intangible service to really know it and services qualities can only be evaluated after purchasing and during production-consumption (Zeithaml 1981). In services, both 'post-sale marketing' and 'word-of-mouth communication' have prominent effects in winning customers' loyalty. Service reliability – performing the service dependably and accurately – is the heart of services marketing excellence according to Berry and Parasuraman (1991). Potential benefits of improved service reliability are improved marketing effectiveness with higher sales revenues, increased productivity and lower costs. The benefit in marketing effectiveness is reached by a higher retention of current customers, increased positive word-of-mouth communications and greater opportunity for charging premium prices. All of these are consequences of improved service reliability to start with.

*Physical distribution* channels are used to display or deliver the physical product or service to the buyer or user, and they are closely connected with the concept of marketing channels (Kotler 2001). *Marketing channels* can be defined as “sets of interdependent organizations involved in the process of making a product or service available for use or consumption” (Stern et al. 1996). The authors emphasize that the marketing channels not only satisfy demand by supplying goods and services at the right place, quantity, quality and price, but also stimulate demand through the promotional activities of the members (e.g. retailers). Therefore, they argue that the channel can be considered an orchestrated network that creates value for the user or consumer through the generation of form, possession, time, and place utilities. The large-scale delivery of products demands different types of efforts that create these utilities, even though there cannot be a “complete” product without including all four utilities into any given object, idea or service. A major issue is delivery, since it is only through distribution that public and private goods can be made available for consumption. A distribution channel comprises two major sectors: commercial and end-user. The commercial sub-system includes vertically aligned marketing institutions (e.g. manufacturers, wholesalers and retailers), and each channel member is dependent on other institutions for achieving his/her goals. A producer is

dependent on others to get his/her product to the end-user and to attain his/her objectives.

A concept in market distribution is channel separation (Bowersox et al. 2002), which can be considered to function as a bridge between marketing and logistics. It focuses on the separation of the ownership transfer and the functions related to logistics. The ownership, or marketing, channel consists of a network of companies that are buying and selling e.g. intermediaries such as retailers. The physical, or logistics, channel represents a network of organizations dealing with achieving inventory movement and positioning e.g. transportation and warehousing. Note, however, that it is possible for companies to participate in both channels. Stern et al. (1996) also present a model that describes the channel as a processing sub-system within the environment, where the boundaries of a marketing channel are geographic (market area), economic (the capability to handle a certain volume of goods or services), and human (the capability to interact). Furthermore, a channel exists also as a part of an economy's distribution structure which includes other channels as well. This structure is, in turn, also a sub-system of the natural environment, which is a sub-system of international environments. All of these environments encompass physical, economic, social, cultural and political sub-systems that influence the development of, and impose constraints on, the focal channel system. The central conclusion is that the marketing channels evolve and function in dynamic environments. In a way, this idea shares a common ground with the sustainability concept, where economic, social and environmental dimensions are interlinked. In this view, the selling of freight transports is part of a distribution structure not only to customers, but also to the political sub-system and to the natural environment.

Christopher (1997) has also brought logistics and marketing together, and the starting point is the purpose of marketing as "the getting and keeping of customers". Traditionally, focus has been to get customers rather than to keep the existing ones on a long-term basis, although the cost is higher for attracting new customers. The concept of *relationship marketing*, though, has contributed to the view of customer relations as partnerships, where the goal of all marketing activities should be the establishment of mutually beneficial partnerships with customers (Christopher et al. 1991; Grönroos 1997). These partnerships are normally long-term and another key element is trust. If these relationships are deepened, they also present an opportunity to co-operate with companies in many areas, e.g. the environmental aspects of transports. This way of viewing customer relations as partnerships is similar to the idea of the extended supply chain.

## 2.3 Logistics theory

Central in logistics and transport research is the concept of **Supply Chain Management** (SCM), which can be defined as “the management of upstream and downstream relationships with suppliers, distributors and customers in such a way that greater customer value is achieved at less total cost” (Christopher 1997). The supply chain represents a value-delivering system (Kotler 2001). Cooper et al. (1997) believed that there is a need for some level of coordination of activities and processes within and between organizations in the supply chain that extends beyond logistics. The definition of Logistics Management is narrower: “the part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements” (CSCMP 2005). So, Logistics Management is only one part of SCM, which constitutes the whole logistics channel.

It is assumed that the increasing trend of globalization of businesses and of supply chain management in recent years has had a drastic effect on the freight transportation system, such as bigger transport volumes, more focus on reliability, time compression, just-in-time<sup>14</sup> deliveries, standardization, and customization (Morash and Clinton 1997; Sulogtra 2002a; Sulogtra 2002b). One reason is that the delivery service and logistics today is considered as an important competitive factor for suppliers of goods (Morash 2001; Morash and Ozment 1996). Therefore, it is essential that there are reliable transport services available for the shipper.

Logistical competency is achieved by coordinating (1) network design, (2) information, (3) transportation, (4) inventory and (5) warehousing, material handling and packaging (Bowersox and Closs 1996). The elements of **logistical value** are service (e.g. availability, performance and reliability) and cost minimization (Bowersox et al. 2002). Bloomberg et al (2002) describe “value-added” as a term that enhances the customer’s perception of a product’s value by creating economic utility. Four economic utilities add value: (1) form utility (i.e. break-bulk operations), (2) possession utility (i.e. transfer of ownership), (3) time utility (i.e. having the products/services available when demanded), and (4) place utility (i.e. having the products/services available where demanded). These are the same utilities as the ones discussed earlier regarding marketing

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<sup>14</sup> The aim of just-in-time systems is to coordinate the supply of materials so they arrive just as they are needed (Waters 1991)

channels, but applied on logistic services. It is safe to assume that especially the possession utility is of great interest to marketing managers, and the *time and place utilities* to logistics managers. Bloomberg et al do not include environmental aspects of transports in these customer utilities, but this is an opportunity for transport providers to include another value-adding utility, which can successfully be done for those customers that appreciate and value knowledge about the environmental aspects of the transports they buy.

When analyzing the freight transports system today and in the future, it is impossible to avoid environmental aspects of transportation. The transport sector has become a heavier polluter of the environment in the last two decades due to increased freight transports, especially on road. There are also several practices causing “excessive” freight truck traffic (e.g. empty running or sub-optimal modal choice), where the most obvious way of minimizing this excessive use is to apply the “Polluter Pays Principle”<sup>15</sup> and internalize its social and environmental cost (McKinnon 1994). This is also discussed at political level and policy makers in the European Union, see e.g. the White book (European Commission 2001), strive for a sustainable transport system. The *modal choice* is identified as a main driver for a sustainable transport system if transport modes are chosen that are better from an environmental point-of-view, especially involving rail. These can be rail transports but also intermodal road-rail transports.

In a review of intermodal rail-truck freight transport literature<sup>16</sup> by Bontekoning et al. (2004), a few conclusions were drawn regarding mode choice and pricing strategies. Mode choice studies reveal the most important mode choice determinants and their sensitivity to change in cost or quality. However, these results were often specific to certain data set, research population and geographical area and hence, not generally applicable. The authors recognize that more research is needed for the mode choice decision-making process and that it is probably more complicated than it is assumed in actual approaches. The authors also recognize that the pricing strategy, i.e. the determination of the right tariff (for both the individual actor in the intermodal chain and for the whole door-to-door transport), is part of the competitiveness problem and that little is known about the costs and appropriate cost calculation method.

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<sup>15</sup> The principle states that those causing pollution should meet the costs to which it gives rise, according to European Environment Agency (EEA 2007).

<sup>16</sup> included 92 publications: 54 articles in scientific journal, 12 dissertations, 3 book chapters, 11 books/reports and 12 papers in conference proceedings during 1988-2000.

Intermodal rail-road transports from a marketing perspective were researched by Harper and Evers (1993). The authors put forward that in order for intermodal road-rail transport to be a viable option for shippers, they must be available to shippers and receivers, the quality and cost must be competitive with other modes, and it must be accepted and used by shippers. The last point is the most important determinant and this depends naturally upon the availability, quality and price factors as well as upon the perception of the transport by shippers. Their results from the US showed that non-users of intermodal transport had substantially lower perception of its performance than users. Also, there was a discrepancy between the quality of service desired and their assessment of the quality of service received among users, especially for intermodal solutions, that lowered the demand and that intermodal transports were rated lower than single-modal transports. This quality gap and the lower rating for intermodal transports were also found in a study in the Nordic countries<sup>17</sup>, about quality requirements that affect the shippers' choices of intermodal and single-mode transports (Ludvigsen 1999). These two mode choice studies found that shippers emphasize overall service rather than cost.

Three general sub-strategies of marketing that may make an intermodal transport system competitive was identified by Jensen (2007): cost advantage, differentiation and focus strategies. Cost advantage strategies can be created in several ways (e.g. economies of scale and scope, loading factors, terminal location), while differentiation strategies can be based on transport quality (e.g. transit time, reliability), environmental impact (e.g. emissions, accidents) and marketing channels (e.g. traditional, internet). Jensen includes environmental impact (negative externalities) as it is a property that is regulated in various ways of society and the trend is an ambition to convert environmental impact to economic decision problems for the actors in the market by internalizing external environmental costs to business economic costs. Finally, focus strategies involve spatial segmentation, customer segmentation, narrow product line and unique specialization. The author points out that all three strategies will always exist in combination, but the aim is to gain a significant, sustainable competitive advantage.

Transports can be positioned at the crossroads of economic and environmental interests (Nijkamp 1994); on the one hand, transports are a necessary activity in an economy characterized by product and labor specialization but on the other hand, transports erode the natural assets of the world. So, mobility of persons and commodities plays a conflicting role in the development of any economy.

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<sup>17</sup>The study included Sweden, Finland, Denmark and Norway.

**Green paradoxes** of logistics have also been identified by Rodrigue et al. (2001) in various dimensions: (1) costs (environmental costs are often externalized), (2) time/flexibility (extended production, distribution and retailing structures consuming more space, more energy and producing more emissions), (3) network (concentration of environmental impacts around major hubs and along corridors), (4) reliability (modes used are the least environmentally efficient: trucking and air transport), and (5) warehousing (inventory shifted in part to roads contributing to congestion and space consumption). Rodrigue et al. conclude that the environment is not a priority in industry, except for where reverse logistics have opened up new market possibilities. Another conclusion is that one way of dealing with the fourth paradox would be to shift freight to other modes of transport that are better from an environmental point-of-view, e.g. electrified railway. This is viable if reliability is still high. Using environmental arguments in the marketing of these transports may contribute to this shift.

### 2.3.1 *Combining logistics theory and purchasing theory*

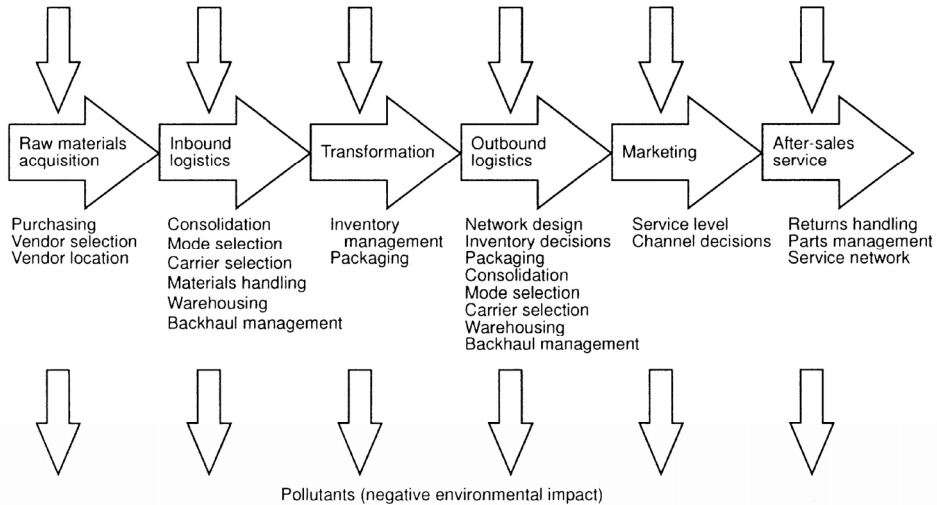
For a long time, environmental aspects of business logistics were mainly associated with **reverse logistics**, which refers to the role of logistics in product returns, source reduction, recycling, materials substitution, reuse of materials, waste disposal, and refurbishing, repair and re-manufacturing (Stock 1998)<sup>18</sup>. Zikmund and Stanton (1971) presented early reverse distribution with solid wastes mainly from consumers and was treated as part of marketing strategy and as an ingredient in the market mix. A few surveys conducted have evaluated the management of environmental aspects and logistics. It has been found a positive relationship between overall logistical competency and the implementation of environmentally responsible logistics practices i.e. mainly reverse logistics practices, in a study by Goldsby and Stank (2000). Also, the concern over environmental issues is greater for larger firms as well as for manufacturing firms, based on a survey study among 450 American firms (Murphy et al. 1995).

Wu and Dunn (1995) claimed that the interface between logistics and the environment is embedded in the value-adding functions that a company performs. They showed in a model, based on the value chain by Porter (1985), how logistics decisions affect the environment and interact with other business functions, see Figure 2.2 (Wu and Dunn 1995). Thus, decisions made in other functional areas may have an impact on logistics, and ultimately on the environment. On the other hand, logistics managers play a critical role in a company's environ-

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<sup>18</sup> For a literature review of reverse logistics up to 1998, see Carter and Ellram (1998).

mental management program because their decisions have a direct impact on the environment e.g. the primary activities of inbound and outbound logistics include mode and carrier selection. Their purchasing function is influential on the environmental impact of the freight transports.



**Figure 2.2 Logistics decisions that affect the environment .**

The buyers of freight transports are organizational, professional buyers. There are some features that are different for *organizational buyers* in comparison to consumers, which affect the marketing. Webster (1978) summarized four sources of uniqueness in industrial marketing: (1) marketing's greater dependence upon other business functions for its effectiveness, (2) product complexity, (3) a high degree of buyer-seller interdependence and (4) the complexity of the organizational buying process. The last one reflects several factors: the influence of formal organization, the large number of persons involved, the complex technical and economic factors that must be considered, the environment in which the company operates, and the frequently large sums of money involved in the transaction. In addition, there is the problem of relating buying response to marketing strategy as there are longer time lags between the application of marketing effort and the resulting buyer response, than in consumer marketing. The purchasing of services by industrial buyers characterizes transport buying behavior.

The organizational buying process also has consequences for marketing communications, which are a vital part of any marketing program. Throughout the



years, there have been several marketing communication models, or also called effects models, presented e.g. the well-known AIDA model (Strong 1925) or the Adoption model (Rogers 2003) Normally, there are three stages in the customer's response: a cognitive stage (knowledge), some have an affective stage (feelings), and all have a cognitive stage (motivation to action) (Smith et al. 1997). Different authors stress the various stages to be most important but the cognitive phase is the most rational one and. Many of these theories presume a high involvement customer responding to mass communications about highly differentiated products. The marketing communication models often target customer markets but, once again, some features differ for organizational buyers. The authors Smith et al. (1997) have matched marketing communication factors with the customer profile of four types: the learning, the self-justifying, the routine, and the professional customer. Some characteristics for the professional customers can be summarized as: price sensitive, focused on technical/reliability/ safety design, having no brand loyalty and requesting technical information. The product differentiation is high and main marketing communication tools are personal selling, PR, exhibitions and direct mail.

The authors Smith et al. (1997) also point out that the professionally trained buyers buy goods and services on the terms and at the quality levels which the organization needs. Usually they negotiate contracts with particular suppliers for a period, often 12 months and those are revised every year. This process demands high involvement of the buyer but the frame contracts also allow the buying over the year to be just routine. This is a way of reducing risks of buying, with high risk assessment once a year and then low during routine buying. The yearly negotiation process is characterized by rationality, which has an impact on the marketing communication. Professional buyers therefore follow two different sequences of stages in the buying-readiness process, see Table 2.1 (Smith et al. 1997).

**Table 2.1 Professional buyers' stages in the buying-readiness process**

When negotiating a supply contract:	Knowings	→Feelings	→Action
Routine buying from an established supply contract:	Action	→Knowings	→Feelings

In the transport buying process, the shippers select among transport providers that can comply with their *transport service requirements*. The factors that are taken into consideration vary but among the most important common factors shown in research are price or transport costs, delivery time, reliability (Hopkins et al. 1993; Jensen 1990; Morash and Ozment 1996; SIKa 2000a).

Additional important factors are accessibility, capability and security (Coyle et al. 2000). In Sweden, the importance of delivery time and logistics flexibility among shippers has also been surveyed separately (Jensen 1997). A few studies have also included environmental aspects of transport purchasing. In a Swedish survey study, companies evaluated a set of factors<sup>19</sup>: modes of transport, cost, frequency, environmental labeling, transport time and on-time delivery (Laitila and Westin 2001). The results showed that time accuracy was the most important transport characteristic and its value increased with distance. Also, the environmental impact was important.

Another study mapped Swedish shippers' environmentally preferable purchasing practice concerning transport services (Björklund 2005) and many companies had applied actions to their own or purchased transports, in order to reduce the environmental impact e.g. coordinated transport flows. This survey study among 50 Swedish shippers found that 90% of those felt that they could exert an influence on the environmental status of the transport suppliers, 80% stated that the environmental consideration had increased in their own firm during the last five years when purchasing transport services, and 92% considered the environmental aspect to a larger extent than required by law. It is clear that the environmental aspects are of growing importance for the purchasers of freight transports in Sweden. It should be even more important in the future considering the trends of increasing freight transports and the related problems.

## 2.4 Purchasing theory

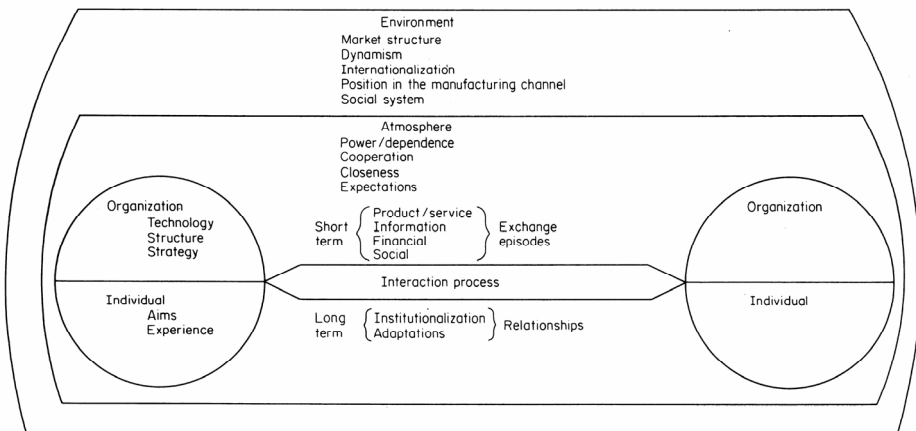
The development of the purchasing function is sometimes described as a process from 'buying', via 'procurement' to '**supply management**', according to Axelsson and Wynstra (2002). Purchasing as in 'buying' is securing that a basic function is bought at the lowest price, while 'procurement' deals with a widened role where e.g. logistical aspects are considered (including volume and time aspects in addition to price). Finally 'supply management' includes even more: formation of supplier structures, development of suppliers' and internal capabilities (resources, knowledge) in order to reduce costs and create value (Kraljic 1983). This development has occurred parallel with and partly as a consequence of the growing share of purchasing volumes compared to sales (Axelsson and Wynstra 2002). It can be assumed that a company's demand for freight transports to be purchased is in most cases derived from the sales volumes.

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<sup>19</sup> The respondents were 493 Swedish companies (in construction, food and manufacturing industries) and the survey used a Stated Preference (SP) technique.

The classic view of *the buying process* is as a sequential decision-making process, whether it is purchasing of goods or services e.g. logistics services. Various authors have described it in a different number of phases. Wind (1978) proposed 12 steps: identify needs, establish specifications, search for alternatives, establish contact, set purchase and usage criteria, evaluate alternative buying actions, determine budget availability, evaluate specific alternatives, negotiate with suppliers, buy, use, and conduct post purchase evaluation. However, it is not necessary to go through all steps if the decision has been made before i.e. routine buying.

The *Buyer-Supplier interaction* processes are important in purchasing and Håkansson (1982) has proposed the ‘Interaction model’ which is composed of four main groups of variables: the interaction process (short- and long-term), the characteristics of the parties involved, the atmosphere in the relationship and the environmental factors, see Figure 2.3. It shares the same grounds as relationship marketing, which has established itself as an underlying paradigm in modern industrial marketing and services marketing (Grönroos 1997), where the core is value creation through relationships, networks and interactions.



**Figure 2.3 The Interaction Model (Håkansson 1982)**

The focus in this model is generally on a two-party relationship with active participants in the market, but can also be applied to a several-party relationship. The relationship is often long-term, involves a complex pattern of interaction and the links between them often become institutionalized into a set of roles that each party expects the other to perform. Previous purchases are also important. This model proposes different factors relevant to study of the interac-

tion process and they are desirable and manageable to include when exploring the purchasing process among shippers, especially the short-term ones. It can be expected that the long-term aspects along with the atmosphere demand more from the research instruments in order to investigate those e.g. participatory observations in order to study these processes.

Another model that to a high extent shares the same grounds as the Interaction model, is the 'Network model' or the 'A-R-A model' (Håkansson 1987). Service production is described in terms of activities, actors and resources which are all present in a network. An industrial network consists of actors that are interrelated since they perform complementary or competitive industrial activities, resulting in value being added to resources through the consumption of other resources. The actors aim at increasing the control of the network. Both the Interaction model and the Network model differ from the classic view of how to purchase effectively; as a rational decision-making process. In the classic view, one underlying assumption is that independence (of selecting the best partner) leads to effectiveness (Gadde and Håkansson 1993) where as the alternative models emphasize the actors and their relations. In addition, Axelsson and Wynstra (2002) also emphasize that the complexity of the service (simple/complex) and the type of problem solution (standard solution for a low price, customized solution for a high price etc) affect the customer's buying behavior and the interplay between the buyer and supplier.

In all views mentioned, whether the classic or network view, *price* is very important when evaluating suppliers. There are mainly three forces that determine price: the production costs, the customer's alternatives (market) and value of the specific service for the specific customer (Axelsson and Wynstra 2002). These can be considered complementary as they are respectively of most importance in different situations. In the classic view, price is *the* relevant cost item to focus on and lower prices are always preferred (Gadde and Håkansson 1993). In the alternative views, value is emphasized more. In order to establish the value of a service for a customer, a possible tool is for example a Customer Value analysis (Anderson and Narus 1998) in order to arrive at the value in monetary terms and is achieved by assessing the costs and benefits of a given market offering in a particular customer application.

Perhaps the most important activity in the buying process, is selecting the best supplier among a number of potential ones. The buying process includes both decision makers and decision influencers which together form the decision-making unit i.e. DMU (Stock and Lambert 2001). There are several methods for *supplier evaluations*. Vendor ratings are based on mainly quantitative measures

for evaluating the performance of the supplier and its product, while supplier audits are more qualitative in order to measure the capabilities of the supplier (Van Weele 2005). Further, audits are more aimed towards a supplier's suitability for future collaboration including new suppliers, whereas ratings are more focused on the past regarding current suppliers. There are different methods for vendor ratings e.g. a weighted point method to arrive at an overall rating for a supplier.

#### **2.4.1 Combining purchasing theory and environmental management theory**

Supply networks are becoming an increasingly strategic issue. Companies are working hard to make the supply chain more efficient in terms of cost and time, but also from a sustainability point-of-view. The concept of **Corporate Social Responsibility** (CSR) has risen on the agenda. Dyllick and Hockerts (2002) transposed the idea of sustainability to the business level and defined corporate sustainability as "meeting the needs of a firm's direct and indirect stakeholders (e.g. shareholders, employees, clients, pressure groups, communities) without compromising its ability to meet the needs of future stakeholders as well". Then companies have to maintain and grow their economic (financial and intangible capital), social (human and societal capital) and environmental capital base (eco-system services, e.g. the protection of the ozone layer). Two important elements of corporate sustainability are to integrate the economic, ecological and social aspects in a 'triple-bottom line', and to integrate the short-term and long-term aspects. The environmental aspect of CSR is interesting for the purpose of this thesis.

Research in Supply Chain Management in connection to environmental aspects covers a variety of functional areas (e.g. purchasing, operations and logistics management) and can be referred to as the **sustainable supply chain**. One concept is 'supply chain environmental management' (SCEM) where four characteristics have proven to be important for successful SCEM programs: (1) Top-level leadership, (2) cross-functional integration, (3) effective communication within companies and with suppliers, (4) effective processes for targeting, evaluating, selecting and working with suppliers (Lippman 1999). Another concept put forward is 'sustainable supply network management' (Young and Kielkiewicz-Young 2001) and a central idea of the authors is that environmentally damaging practices in supplier operations can directly affect the way customers relate to an organization's products and services, as well as how the regulators treat it. On the other hand, this can also be turned into a competitive advantage if this would be used in an efficient manner. Also, the reduction of environmental effects may be larger if this would be integrated in the supply chain in-

stead of only in one company. In relation to environmental aspects of freight transports, this research area shows that the integration and communication between different functional areas (e.g. logistics and environmental departments) and with suppliers (i.e. transport providers) are vital for a successful implementation in the supply chain. Then this achievement may be an opportunity to use it in marketing as a competitive advantage.

Environmental Supply Chain Management for an individual firm can be defined as “the set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm’s goods and services” p. 69, Zsidisin and Siferd (2001). There have been various studies in *environmental purchasing*, which is an extension of the purchasing theory, and many studies have been conducted in the areas of source reduction including recycling, reuse and waste elimination strategies (Min and Galle 1997). Environmental aspects are included as a non-economic buying criteria which is a criteria other than price or the trade-offs made between price and the many, varied dimensions of quality (Drumwright 1994). Lamming and Hampson (1996) considered the environment as a strategic opportunity for purchasing, where the supplier selection plays a vital role. There has been a lack of user-friendly tools for this purpose though (Noci 1997).

Kraljic (1983) was first to introduce a general portfolio approach for purchasing and supply chain management but others have followed, see e.g. Gelderman and van Weele (2005) for a review of purchasing portfolio models. A portfolio approach for identifying green purchasing strategies was proposed by Murray and Cupples (2001). They have two dimensions measured in a 2×2 matrix: environmental risk (according to the environmental impact of the purchase and to the perception of others outside the organization) and profile risk (in terms of e.g. public perception and publicity of purchase, the potential to detract from the organization’s “good environmental practice”). The objective is different depending on the strategy chosen. There is a great difference in what resources to put in the environmental purchasing between the two contrary approaches: to create environmental awareness at lowest cost (high environmental risk/high profile risk) or to minimize risk by supplementing existing appraisal tools (low environmental risk/low profile risk) e.g. whether to choose a second or third party accreditation, how detailed the questionnaire for supplier evaluation should be etc.

Drumwright (1994) studied 35 buying processes among companies and identified two types of organizational players: policy entrepreneurs and converts. The

policy entrepreneurs had initiated socially responsible buying processes, had worked to get them on the corporate agenda, were driven by personal commitment and were often found among middle management but not in charge of purchasing. Converts initially resisted the socially responsible buying but experienced a change in behavior as well as in attitudes and beliefs, and were often purchasing professionals. One reason suggested was due to a perceived role stress and role ambiguity. This is in line with Michaels et al. (1987), that found that this could be reduced by using explicit written roles, policies and procedures in industrial buying.

The regulatory sector had generally been identified as the most prominent driver of a company's environmental activities (Murphy et al. 1995). However, when Carter and Carter (1998) tested the impact of different inter-organizational determinants of environmental purchasing, they found that the regulatory sector did not significantly impact these activities. Instead, the output sector (i.e. downstream channel members such as distributors, retailers and consumers) was the primary driver and the authors emphasize the importance of supply chain management of environmental activities (including marketing, customer relations, distribution, and manufacturing). They proposed increased efforts that direct the attention downstream e.g. developing new technology, increasing public relations and green marketing activities, and establishing closer relations with channel members. Carter and Jennings (2002) narrowed down CSR issues to those relating to logistics in a framework of Logistics Social Responsibility (LSR). Drivers of LSR identified were organizational culture, top management, individual values, liability, marketing and PR and regulation. Barriers were availability, coordination and organizational culture, but those were overcome by feedback (e.g. coordination across functions or organizations in the supply chain), developing written policies (e.g. ISO 14001), allocation of resources and individual values (e.g. improved employee motivation). The importance of individual values is in line with the findings of Drumwright (1994) discussed earlier.

## **2.5 Environmental management theory**

Traditionally, nations were competitive when their companies had access to inputs (capital, labor, energy and raw materials) to the lowest cost. Porter and Van der Linde (1996) put forward that competitiveness today is obtained by using resources more productively, where companies produce existing products more efficiently, or by making products that are considered more valuable to customers and that customers are willing to pay more for. They claim that how

an industry responds to environmental problems may be a leading indicator of its overall competitiveness.

Corporate environmentalism has emerged and has been redefined through successive stages with differences in the external pressures driving corporate activities, internal structures and how corporations responded. Hoffman (2000) divides this evolution in four periods: industrial environmentalism (1960-1970), regulatory environmentalism (1971-1981), environmentalism as social responsibility (1982-88) and strategic environmentalism (1989-1999). In the first period, authorities played an active role but over time, industry has taken a more proactive stance. Roy and Vézina (2001) claim that environmental management has gone from an add-on function to being an integral part of business operations, since it is often viewed as vital for a corporate mission. Companies have realized the strategic advantage of, on one hand, satisfying environmental conscious customers along with increasing demands for environmental technology, and, on the other hand, ensuring that business activities get adapted to environmental concerns (Dobers and Wolff 1995). The institutional theory emphasizes the role of social and cultural pressures on an organization influencing organizational practices and structures (Scott 1992). DiMaggio and Powell (1983) suggested that actors adapt to pressures and values in an organizational field by different mechanisms of institutional isomorphism: coercive isomorphism, mimetic pressures and normative pressures. This theory has been applied to track processes driving corporate environmentalism, e.g. Delmas and Toffel (2004) and Strannegård (2000).

Theory building concerning environmental aspects of business has evolved. Wolff (1998) questions if e.g. green marketing or green strategy development is different from the established theories, maybe in its complexity (since environmental problems cannot be solved by individual actors; they are cross-disciplinary by nature and extremely emotive), but it is from a management perspective structurally similar to other complex problems. Various environmental management models have been proposed. For an overview, see Kolk and Mauser (2002). The possibility of combining economy and environment has been discussed. If they are compatible, then the question is whether they are cost neutral to the company (neither costs nor extra benefits) or profitable (a win-win situation) (Kolk 2000). The compatible view has dominated and authors from the “conflicting side” have questioned the win-win view, e.g. Walley and Whitehead (1994). A third view put forward is not whether it pays “to be green” in yes-or-no terms, rather “the right policy depends on the company’s circumstances and the strategy chosen” (Reinhardt 1999).



Regardless of how environmentalism emerges, it is often formulated into an ***environmental strategy*** which is a part of the strategic management. Strategic management is central and is a continuous process that involves the efforts to successfully fit an organization into its turbulent environment by developing competitive advantages (Stead and Stead 1996). It involves translating the company's core values into actions that assure its survival within its environment, capitalizing on opportunities and minimizing threats. The environmental strategy is a part of strategic management. Hoffman (2000) points out that environmental strategy is not equal environmental management, which can be driven by regulatory compliance (what companies must do to stay legal) or by social responsibility (what corporations should do). In both cases, corporations do little to protect the environment unless the government or society forces them by sanctions. In an international perspective, this may differ where companies in the Anglo-Saxon world work in a more pro-active way rather than reactively to legislation (Wolff 1998). A study of S&P 500-companies (Khanna and Anton 2002) showed that regulatory threats encourage environmentally-friendly organizational changes that enhance compliance, but they are not strong incentives to adopt practices that improve relations with the public and increase product efficiency. Disclosure of environmental information and competitive pressures are more effective in inducing companies to adopt practices that enable them to reach strategic business goals.

The first step in the implementation of a system of environmental management is the development of a ***Corporate Environmental Policy (CEP)***. The key inputs to this policy are the findings of the initial environmental review, the outcomes for environmental management, external expectation of the business (e.g. triple bottom line, sustainability) and overall business objectives (Sullivan 2001). In a study of 187 large European companies (Hibbitt and Kamp-Roelands 2002), almost all (91%) the companies had implemented a CEP and the leading companies were found in Norway and Sweden. When implementing an environmental strategy, a company must decide upon an appropriate way to signal a superior environmental performance to stakeholders by using e.g. Corporate Environmental Reports, Environmental Management Systems, and Eco-labeling programs.

A ***Corporate Environmental Report (CER)*** vary in content and an important challenge is to find standards that assure the reliability of reported data (KPMG/Wimm 1999). Corporations provide stakeholder groups with little information about their efforts to improve future environmental performance, but the ISO compliant companies use more target measures than non-compliant companies (Marshall and Brown 2003). Some companies have embarked on sustainability reporting, where integrated Triple Bottom Line reporting involves

one single performance measurement (KPMG/Wimm 1999) and the guidelines of Global Reporting Initiative (GRI 2004) are frequently used. A study of Swedish companies using the guidelines showed that management obtained a useful overview when collecting the data, which could be used in case of an external demand for information about the company (Hedberg and von Malmberg 2003). A study by Kolk (2003) showed a significant rise of sustainability reporting between 1998 and 2001, and such reporting was used by approximately half of the Fortune Global 250 companies (although environmental issues received most attention).

An *Environmental Management System* (EMS) provides standards prepared by regional, national, and international standard bodies, containing demands (e.g. on environmental policies and goals, environmental strategies, plans of revisions), where all activities aim at constant improvement (Starkey 1999). An EMS is not only a rational management tool for action, but also for communicative action and organizational learning (Burstrom von Malmberg 2002). The total number of ISO 14001-certifications in the world was estimated in March 2006 at about 88,000, with Japan in the lead (CRM 2006). A study of large European companies showed that almost two-thirds had an EMS but nearly as many as 10% did not have any EMS anywhere within their organization, and also that ISO 14001<sup>20</sup> was more popular than EMAS<sup>21</sup> (Hibbitt and Kamp-Roelands 2002). A review of studies carried out by Morrow and Rondinelli (2002) focusing on motivations of companies adopting EMS, showed that large multinational companies wanted to extend EMS to suppliers. Companies in the international markets, especially in the US and Europe, often considered EMS to be a way of developing competitive advantage. In the case of the transportation chain, the actors are also affected by an EMS if e.g. a company assesses and communicates environmental demands to transport providers.

*Eco-labeling* shows that an independent body of certification has approved the product. The driving forces have been growing consumer concern about the environmental impact of products and services, along with increased misleading claims from producers (Roy and Vézina 2001). An eco-labeled product has an advantage over a conventional one but it also refers to ills that can be avoided or ideals that can be achieved in relation to the present production and consumption patterns (De Boer 2003). It is closely linked to pressures from various ac-

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<sup>20</sup> the International Organisation for Standardisation, a network of national standards institutes of 148 countries (ISO 2007).

<sup>21</sup> the Eco Management and Audit Scheme i.e. the standard of the European Union (European Commission 2007)

tors in society wanting to change these patterns in a more sustainable way. In Sweden, there are criteria for passenger and freight transport, where the requirements placed are on the use of non-renewable energy, manufacturing and distribution of energy driving the vehicles, and correct disposal of materials of vehicles when scrapped (SNF 2007).

Logistics managers who take environmental aspects into consideration are confronted with calculations of the environmental load of transports, often included in a *Life Cycle Assessment* (LCA). This tool sheds light on a product's environmental impact at every stage from extraction to disposal; a cradle-to-grave approach (Welford 1999). It is complicated by a lack of standard values in the calculations, which produces variations in the outcomes. A Swedish example where organizations, companies and researchers work for common bases of calculation of the environmental impact of transport is the "Network for Transport and the Environment". They have e.g. developed a tool to facilitate calculations for transport buyers and a questionnaire for transport supplier evaluation (NTM 2005). In research, Enarsson (1998) developed a tool for the evaluation of suppliers with regard to the environment, but did not include other factors such as price and quality. However, these also have to be taken into considerations in real life.

### **2.5.1 Combining environmental management and marketing theory**

Companies are more and more considering environmental differentiation to be a basis for their competitive strategy (Roy and Vézina 2001). When considering environmental issues in the re-engineering of processes, an environmental commitment is required if environmental claims in the marketing are to be used. "Greenwashing" is the misuse of the principles of environmental marketing, and green advertising reflects environmentally sound strategic- and structural-level decisions (Kärnä et al. 2001). Literature on marketing and the natural environment has been developed over the years. This is often referred to as *green marketing*, which can be considered to be an umbrella term for a range of concepts such as green, ecological, environmental and sustainable marketing (Crane 2000). Alternatively, it can be defined as the practice of incorporating environmental topics e.g. recyclability or product labeling, into the marketing efforts of the company (Stock 1998). Many of the authors in green marketing focus mainly on consumer markets but it can include greening of products as well as greening of companies, and a first consideration is to identify what ought to be greened: systems, processes or products (Prakash 2002). Crane (2000) adds another dimension by exploring the literature from the point-of-view of morality and he identifies various perspectives. Smith (1998) is skeptic about green

consumerism, which he considers a social myth that unconsciously helps us to smooth over the questioning of consumption-expansion logics i.e. a type of happy ending to the environmental crisis, implied by green marketers that makes no ecological sense.

The term *sustainable marketing* was coined by Sheth and Parvatiyar (1995), but it was also used by Fuller (1999), and describes a marketing approach that promotes sustainable development and protection of the eco-system. Four actions are required to build a strategy for sustainable marketing: promoting re-consumption, redirecting customer needs and wants, reorienting the marketing mix and reorganizing organizational efforts (Sheth and Parvatiyar 1995). Peattie (1995; 1992) focuses on identifying green consumer behaviors and how to introduce the environmental criteria in the marketing mix. He also listed ten key characteristics of environmental marketing (Peattie 1995). One is that environmental marketing should not be confused with attempts to exploit consumers' environmental concerns to promote companies or sell products but, rather, it is about a balanced approach to meeting their genuine needs. Environmental marketing is also to view the company and all its activities as parts of the "product" promoted. Environmental marketing is a balanced approach to social, technological, economic and physical aspects of businesses and societies, but it should be recognized also that consumers and societies have multiple and sometimes conflicting wants and needs. This last point is relevant to have in mind regarding the marketing of environmental aspects of freight transports. In marketing strategies, differentiation can be used based on the analysis of potential target groups since there are many stakeholders interested in minimizing negative environmental effects from freight transports; politicians, creators of public opinion and last but not least, the public. This way of tackling the problem is a type of social marketing (Kotler et al. 2002).

Successful marketing can be based, among other things, on a seller emphasizing and promoting product characteristics that differ from competitors' alternatives, i.e. the seller aims at product differentiation. Is *environmental product differentiation* possible? Reinhardt (1999) has proposed five ways of integrating the environment into management and one of them is through product differentiation. The idea behind environmental product differentiation is that companies create products or employ processes that offer greater environmental benefits or impose a smaller environmental cost than what those of the competitors do. This can raise the company's costs but may also permit the company to raise prices, to capture additional market shares or both. Three conditions must be met in order to successfully implement environmental product differentiation. First, one has to identify customers that are willing to pay more for an environmentally friendly product. Second, one has to communicate the product's envi-

ronmental benefits in a credible way. And third, the company has to protect itself from imitators long enough to profit on the investment made. This analysis is based on the marketing theory of sustainable competitive advantage that was discussed at the beginning of this review of literature. The loop around the quadratic framework model is now closed, and, hopefully, the knowledge of these four research fields has increased along the way.

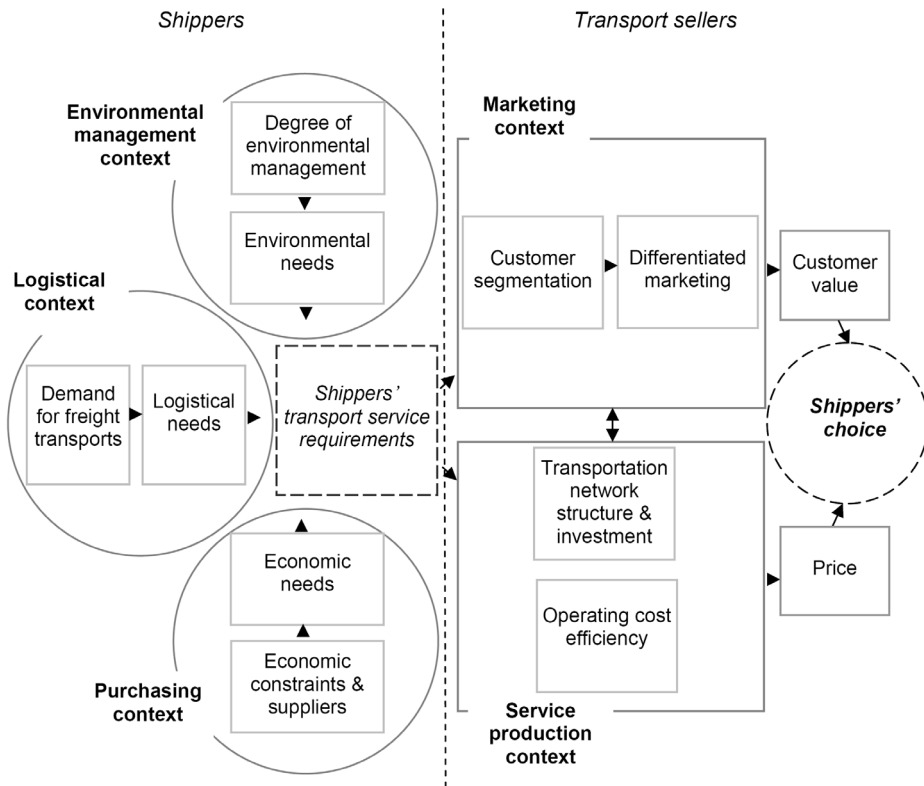
## **2.6 Model of analysis from theoretical framework**

The conceptual framework proposed links marketing, logistics, purchasing and environment management research together, in order to highlight common concepts and thoughts. The concept of value is central no matter if it concerns marketing (e.g. customer value, value-adding activity, value chain), or logistics (e.g. value-adding services), purchasing (value for money) or environmental management (the use of e.g. EMS, eco-labeling, environmental reporting) Also, interesting research has developed within their interfaces. If the findings made in the four theory fields are put together in a more process-focused model, it can be used as a tool to analyze potential target groups for marketing of environmentally preferable transport services, see Figure 2.4.

The model makes a distinction of the shippers' domain and the transport sellers' domain, where the theory fields can be positioned. The Environmental management context, the Logistical context and the Purchasing context among the shippers leads to certain needs on the transport bought in the shape of Shippers' transport service requirements. The importance, or thus need, to the shipper of each factor varies between companies buying freight transports. For example, shippers have reached different levels of advancement in regards to environmental management including various implemented systems, e.g. EMS. This affects to what extent environmental considerations are influencing the decision-making process in transport purchasing. Assume that Shipper A has worked for a long time with environmental management and has achieved constant improvements, where as Shipper B has not started the process and does not even have an environmental policy. Then a market offering of an environmentally preferable transport service can be assumed to have a higher perceived value to Shipper A than to Shipper B. The Environmental management context helps in defining the environmental needs of the shipper, which is assumed to originate from the degree of environmental management the shipper has reached.

All demands from the three contexts are then put forward to the transport providers selling transports, normally through personal communication. This en-

counter is the chance for the transport sellers to enter the shippers' world and get information about how the various aspects are valued and weighted. This is an important part of the interaction process. The obtained knowledge about the shippers is brought into the marketing context of the transport sellers.



**Figure 2.4 The use of theory in marketing, logistics, purchasing and environmental management for the marketing of environmental advantages in freight transportation.**

The transport sellers have their marketing to work with. Based on shippers' transport service requirements, it is possible for the transport providers to identify customer segments. This will guide how the marketing of transport services offered will be differentiated. The aim of the marketing activities is to create customer value for the shippers.

At the same time, the Service production context will define the transport sellers' outer frames of possibilities of the transport service offered. The focus in

this thesis does not stem from the service production, but rather from the Marketing context with the demands and preferences of shippers i.e. the approach is demand-driven rather than production-driven. The service production context is included in the model since this is what the minimum price of the transport services is based on when set. Additional factors that influence are customers willingness to pay and competitors' prices. However, costs incurred are not discussed in detail in this thesis and will only be briefly mentioned here. The price set is based on production costs which can be classified in various ways. For example, Bloomberg et al (2002) divided production costs into fixed costs (e.g. capital invested in vehicles), variable costs (e.g. fuel costs), joint costs (e.g. an incurred back-haul service of another transport) and common costs (e.g. a shared shipment of many deliveries). There are other ways of classifying production costs and of allocating common costs. Bardi et al (2006) point out that the variable, or marginal, cost of the service should serve as a price floor but the price set should rather be the value of service (and the average cost or fully allocated cost is somewhere between the two).

In this thesis, price is considered as a fixed output of the service production context. It is assumed to originate from two main sources that in turn include a whole range of components. The first category is the 'operating cost efficiency' of the transport sellers. The second category of service production costs originates from the 'transportation network structure and investment'. A transport provider can be a coordinator and/or carrier. The role may vary depending of what transport network the transport provider is part of. This also affects how the shipments are performed, points of consolidation, geographic coverage etc. The costs incurred including investments must be covered by the price charged to the customers. Naturally, the price can be adjusted depending on the importance of the deal, e.g. the marketing value of getting a key customer, or for other factors apart from the service production costs.

In the end, it is the shippers that make the final choice based on the various dimensions melted together as the perceived customer value of the offer together with the price offered. This is the second encounter in the interaction process when the shippers and transport sellers meet through personal communication. Once again, this is an opportunity to exchange information and exert influence on one another. The shippers can communicate to the transport sellers, that were not chosen, how to improve in order to get selected in future business deals. This works as a feedback function for transport sellers of their production and marketing efforts and how they may need to adjust these. In the model, the two crucial points of encounter in the interaction process are marked with a dotted line around the text boxes.

This process-focused model presented can be used as a tool to create customer value for freight transport buyers, taking both their needs for transports and environmental management commitment into consideration and adding the financial and relational aspects in purchasing. It highlights the need for knowledge about the transport customers, e.g. their valuation of the environmental aspects of the freight transports they buy. Only then is a segmentation of transport customers possible. Transport sellers can then utilize this segmentation by adopting a differentiated marketing strategy. Environmental arguments can be employed in the marketing communication with selected target groups among shippers mainly. Furthermore, this can also include communication with other stakeholders, such as transport policy-makers, who can influence the incentives for choosing environmentally preferable transport services, e.g. through modal shift.

Freight can be transported by rail, or by intermodal road-rail transports, instead of by truck in order to improve the environmental performance of the transports. In this way, customers that value environmental aspects of their freight transports can be satisfied as transport providers have created customer value for these customers. This customer value improves the chances of developing a long-term relationship between transport providers and these target groups. This is a key factor to success according to relationship marketing theory (as discussed in Section 2.2.1) and important in the buyer-supplier interaction process in purchasing theory (as discussed in Section 2.4). It is an opportunity for transport providers to be a vital, indispensable part of many supply chains.

This resulting conceptual model will help further on in the thesis, by forming a foundation for the presentation of conclusions in Chapter 9.



## 3 Research questions

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### 3.1 Discussion

The purpose of this thesis is to explore the potential of using environmental arguments in marketing of intermodal road-rail freight transports. The purchasing of freight transport services is central, since the persons in charge of this function in the transport buying companies form the demand base. A customer analysis in order to scrutinize the demand base is crucial in all marketing efforts and the results have influence on customer segmentation and marketing differentiation. Also, marketing of freight transport services have two important features: they are services and they involve professional buyers. This brings implications for e.g. marketing communication, which will be discussed later.

An important issue in marketing is to identify the main decision-makers in charge of the purchasing of the products or services to be marketed. It is normally the seller of goods – the shipper – that buy the freight transports needed. The purchasing of freight transports are normally not done by the purchasing department, but by the one responsible for outbound transports; the logistics manager or equivalent, someone else at the logistics department, or someone in production at smaller companies. Still, the function is purchasing of services. Three main reasons for purchasing services (Axelsson and Wynstra 2002) are that the buying firm does not have sufficient:

- capabilities to perform the service efficiently with the right quality, or
- scale or ability to perform the service cost efficiently or
- capacity to perform the service (completely or at all).

The complexity of the service sold and the type of problem solution are worth attention as Axelsson and Wynstra (2002) emphasize that these affect the customer's buying behavior and the interplay between the buyer and supplier.

Freight transport services can in some cases be considered as a standard solution for a low price, often for smaller firms with few deliveries ordering a standard package delivery through a transport provider's net. In most other cases, there is a quite complicated buying process in order to select transport providers. They often customize solutions for that particular company and thus, might charge a higher price than for the standard solutions. This is often the case for companies that generate quite a large amount of freight volumes, and therefore also can put forward demands on how their transports should be performed to the transport providers.

In the transport buying process, the shippers select among transport providers that have attractive prices and can meet the demands put on them. Among the most important common factors that are taken into consideration shown in research are; price or transport costs, delivery time, reliability but also accessibility, capability and security (Coyle et al. 2000; Hopkins et al. 1993; Jensen 1990; Morash and Ozment 1996; SIKa 2000a), which was discussed before in Section 2.3.1. Another example from research is McGinnis (1990) that, based on a review of 12 American studies, identified six factors that shippers considered important when choosing between transport alternatives: (1) freight rates, (2) reliability, (3) transit times, (4) over, short and damaged, (5) shipper market considerations, and (6) carrier considerations. In most of these studies it was concluded that quality had more influence on the transport decision than price, although cost is often more important than many individual service characteristics. A parallel conclusion was drawn about Swedish shippers in a study of Nordic shippers (Ludvigsen 1999) as the least-cost preferences did not function as a single and primary criterion for operator and/or mode selection, but it worked in the conjunction with the needs to satisfy several other service requirements.

Research on choice of transport mode is very relevant for this study. Evers et al (1996) surveyed how shippers among manufacturers perceived different modes of transport based on those six selection criteria (factors) discussed above (McGinnis 1990). The order of importance was found relatively similar across modes, indicating that shippers generally form overall perceptions of different modes based on similar weightings of individual factors, and more greatly affected by timeliness and availability. The intermodal shippers perceptions of individual carriers, instead of modes, were later studied (Evers and Johnson 2000) and the results identified communication and customer service to be the biggest drivers of the shipper's overall perception, not timeliness and availability. However, it is a combination of factors: communication, transit times, consistent delivery, quality of customer service and competitive rates.

This thesis studies intermodal rail-road transports from a marketing perspective, which hardly has been done in prior research. However, two interesting studies were mentioned in Section 2.3;

In the *first* study, Harper and Evers (1993) put forward some requirements on these transports in order to be a viable option: they must be available to shippers and receivers, the quality and cost must be competitive with other modes, and it must be accepted and used by shippers. The last point is the most important determinant and depends naturally upon the availability, quality and price factors as well as upon the perception of the transport by shippers. Non-users of intermodal transport had substantially lower perception of its performance than users. Thus, the image of characteristics of a transport mode is very relevant in mode choice. Also, there was a service quality gap between the desired service quality and their assessment of the service quality received among users, especially for intermodal solutions and that intermodal transports were rated lower than single-modal transports.

In the *second* study, this quality gap and the lower rating for intermodal transports were also found in the Nordic countries<sup>22</sup>, also when Sweden was analyzed separately, about quality requirements that affect the shippers' choices of intermodal and single-mode transports (Ludvigsen 1999). These two mode choice studies found that shippers emphasize overall service rather than cost. These findings about the preferences of transport modes are important for the scope of this thesis, where intermodal road-rail transports are in focus. The mapping of needs and demands among freight transport customers is necessary, along with the attitudes towards different modes of transports. Based on this gathered information, it would be possible to identify segments of shippers that would be the best suited target groups for using intermodal road-rail transports.

The better environmental performance of intermodal road-rail transports than transporting on road, may offer a competitive advantage as discussed before. A tool for the marketing of intermodal freight transports would be segmentation once again. It should be possible to identify segments among potential users of this transport mode, based on their preferences and attitudes towards environmental aspects of their transports. However, there are several possible ways for segmenting companies. An example from research discussed before is the importance of size as concern about environmental issues is greater for larger firms as well as for manufacturing firms (Murphy et al. 1995), see Section 2.3.1. The size of a company is important as larger companies have more re-

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<sup>22</sup>The study included Sweden, Finland, Denmark and Norway.

sources that can be devoted to environmental issues and they are also more exposed to public criticism than smaller ones (Preuss 2001). Another interesting finding for this thesis is that logistics plays a more prominent role in the implementation rather than in the formulation of environmental policy (Murphy et al. 1995). In line with this, an interesting question is whether shippers' environmental policy has an impact on the purchasing of freight transports in Sweden. The buying of transport services are dealt with in classic logistics literature (Bloomberg et al. 2002; Bowersox and Closs 1996; Christopher 1992; Coyle et al. 2000), but do not usually include environmental considerations in the buying process. If environmental aspects are mentioned, then it is in the context of reverse logistics, Life-cycle assessments (LCA:s), or safety. The strategies most commonly used in logistics to respond to environmental issues are mainly recycling materials, reducing consumption and reusing materials (Murphy et al. 1995) i.e. reverse logistics. This is in an international context and a majority of these authors have done research on American companies. However, this might be starting to change e.g. Enarsson (2006) make a connection between shippers' freight transports and their environmental management systems.

In reality, environmental concerns are taken into account when freight transports are purchased to some degree, at least in Sweden, and there have been a few Swedish studies regarding this topic. As discussed before in Section 2.3.1, Laitila and Westin (2001) showed that time accuracy was the most important transport characteristic, but also that environmental impact was one of the most important transport characteristics, regardless of whether it involved metropolitan areas, rural areas or other areas in Sweden. Björklund (2002) showed in an interview study with 15 Swedish companies that purchasers often use questionnaires about the carriers' environmental performance. However, it was not solely used to select suppliers but also to collect information about their environmental work. The same author did a survey study (Björklund 2005) and found that 90% of the participants felt that they can exert influence on the environmental status of the transport suppliers, 80% stated that the environmental consideration had increased in their own firm during the last five years when purchasing transport services, and 92% considered the environmental aspect to a larger extent than required by law. The demands that influenced most were from top/middle management, environmental managers and customers. Apart from the mentioned studies, there is a lack of literature in this area and more knowledge is needed.

Before moving on, it is helpful to define the focus of this thesis; environmental considerations among shippers when freight transports are purchased. Few definitions are presented in literature in relation to green or environmentally sound logistics services, and it often refers to reverse logistics. However, this thesis

aims at freight transports that can be considered as better from an environmental point-of-view in comparison to other transport services offered i.e. environmentally preferable transport services. A definition of these was proposed by Björklund (2005), p.78: “Transport services that have a lesser or reduced negative impact on human health and the natural environment when compared with competing transport services that serve the same purpose”. In this thesis, this definition of these transport services is used and referred to as environmentally preferable transport services.

In the purchasing of environmentally preferable services, an important activity is supplier selection. Research in the UK has shown that the most commonly used methods for purchasing managers for evaluating suppliers’ green credentials are questionnaires, third party certifications and visits to suppliers (Murray and Cupples 2001). Also, ‘green’ vendor rating systems that include the use of both qualitative and quantitative information in supplier evaluation has been proposed (Noci 1997). In Sweden, at least one major company uses vendor ratings where the environmental aspects are included in purchasing of transport services (Björklund 2002). This type of research which concentrates on how environmental aspects influence purchasing, as well as logistics, has developed during the last few years.

In sum, what this thesis does is tackle a market analysis problem of freight transport buyers with regards to environmental aspects and road-rail intermodality. Information about the needs, preferences and attitudes among shippers towards the intermodal road-rail transports, as well as towards environmental aspects of their freight transports needs to be collected. Only then is it possible to use segmentation of the shippers in Sweden based on their demand for freight transports depending on e.g. their freight volumes sent. This may influence the differentiated marketing strategies towards these segments and would facilitate marketing activities. When these data about the shippers have been collected, it is possible to fulfill the purpose of this thesis: to explore the potential of using environmental arguments in the marketing of intermodal road-rail freight transports.

### **3.2 Implications from theory**

A sustainable transport system is a concern for many stakeholders, as pointed out earlier, and it is therefore of interest to increase the share of intermodal road-rail transports. One possibility of doing so is to emphasize the environmental advantages through marketing efforts. Research in marketing is a broad field and therefore it is important to narrow down the scope of this study. In

clarifying what areas this thesis will concentrate on, the model of strategic analysis by Aaker (2001) will be used. This was briefly described earlier in Section 2.2. and is summarized in Figure 3.1 (Aaker 2001).

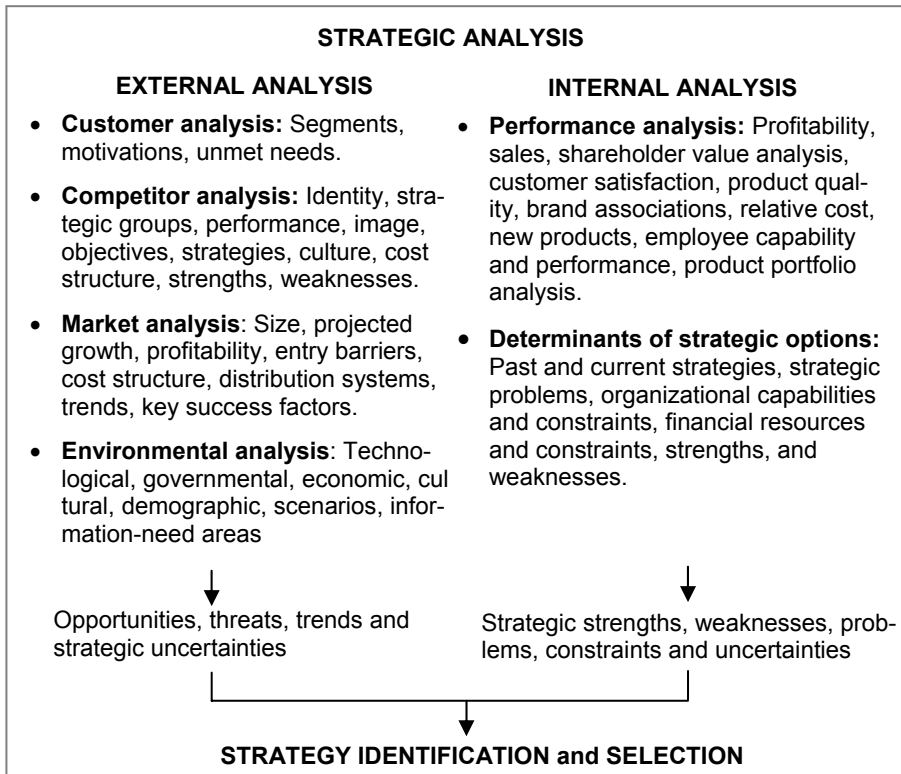


Figure 3.1 Brief overview of Strategic market management

The scope of this thesis lies mainly within the external analysis, as seen from the perspective of the carriers and other promoters of intermodal transport. It is composed by four pillars focusing on customers, competitors, the market and factors in the business environment. The customer analysis includes different segments, motivations and unmet needs. The contribution of this thesis is to provide and analyze crucial data needed in order to do valid external analyses, especially concerning the customer analysis. First, basic data are needed about the transport buyers, which forms the demand basis. Second, information is needed regarding the extent to which the customers of transport services value environmental aspects, especially in the transport buying process.

The market analysis includes key data about the market e.g. size, trends and key success factors. The market of intermodal road-rail transports must be mapped within the scope of this thesis. This market form part of a certain business environment where many have interest in its development due to e.g. governmental, economic, technological and demographic factors. The market analysis and environmental analysis have already been dealt with partly in the background chapter (Chapter 1). In sum, the parts of the model where the results of this thesis can contribute most are to the customer analysis, and to some extent also the market analysis (especially when estimations of the total freight volumes in Sweden are calculated in Section 6.1).

The internal analysis lies within the boundaries of each company or organization, and will not be dealt with. The author Aaker believes that creative, proactive strategies can influence governmental policies, customer needs and technological developments, and, to some extent, make these factors controllable. However, there will be no attempt to identify and select strategy on behalf of the potential marketers e.g. transport companies, policy-makers etc. Neither will promotion strategies or product differentiation strategies be elaborated based on the results of this thesis.

The findings of the review of literature in Chapter 2 have implications for the components in the marketing context of freight transport services identified in the resulting conceptual model (see Figure 2.4); customer segmentation and differentiated marketing.

### **3.2.1 Implications for customer segmentation**

Firstly, there are implications for *customer segmentation*. In this thesis, customer segmentation is referred to as a way of dividing the freight transport market, into various groups of shippers based on a number of potential variables. The results of this thesis will be discussed in the light of these variables in the conclusions (Chapter 9). However, theory had contributions to this subject.

In most strategic market-planning contexts, the first logical step is to analyze the customers in a customer analysis which forms part of the external analysis in the proposed framework by Aaker (2001). This provides an understanding of the market segments, customer motivations and unmet needs. However, the author believes that it is the customer segmentation that is often the key to developing a sustainable competitive advantage which is based on differentiation, low cost, or a focus strategy. Segmentation can be based on a whole range of variables, mainly relating to general customer characteristics (e.g. size of firm,

type of organization, geographic location) or product-related approaches (e.g. usage, user types, benefits sought, price sensitivity, brand loyalty). Two distinct segmentation strategies are; the focus strategy on a single segment, or involving multiple segments. After identifying customer segments, it is time to analyze the customer motivations e.g. what elements of a service do customer value most and how segments differ in their motivation priorities. The third part of the customer analysis involves the unmet needs. These are strategically important because they represent opportunities for companies to increase their market share, break into a market, or create and own new markets.

The idea of the service-driven logistics system, i.e. a system that is designed to meet defined service goals, is described by Christopher (1992). This should not be driven by production-orientation, but by market-orientation based on service needs of the various markets. The starting point is by identifying customers' service needs and going through a process of service segmentation, proposed by the author. The first step is to identify key components of customer service as seen by the customers themselves. The goal is to explore the relative source of influence upon the purchase decision. The second step is to establish the relative importance of those service components to customers. The author suggests a way of discovering how important each element of customer service is to a customer by asking a representative sample of customers to rank, or place weight on a rating scale, or to allocate a total of 100 points amongst the elements listed according to perceived importance. The third step is to identify "clusters" of customers according to similarity of service preferences.

This way of accomplishing service segmentation of the total market can be applied to the freight transport market where some purchasing criteria may be reliability of delivery, flexibility, price or technical expertise. This can be expanded though as different environmental aspects of the freight transports can be considered as a set of service components of the transport offer. Also different aspects of transport modes offered, could be considered in a similar fashion e.g. intermodal road-rail transports. It can be assumed that different segments of customers put different emphasis on e.g. the environmental aspects. The key is to explore which of the freight transport customers put value on these alternative service aspects, and also in relation to the other traditional service aspects, and what the influence is upon the purchase decision. Aaker included unmet needs in the customer analysis and it is useful to consider shippers' satisfaction with transport providers contracted in order to identify if there are any unmet needs regarding transport services.



### 3.2.2 Implications for differentiated marketing

There are also implications for a differentiated marketing which is based on customer segmentation. Marketing differentiation of the market offering may include variables relating to five dimensions: product, services, personnel, channel and image (Kotler 2001). Each dimension has a range of parameters e.g. 'product' includes form, features, performance quality, reliability etc and 'image' includes media and events. A company needs to developing a distinctive positioning for its market offering, which is 'an act of designing the company's offering and image to occupy a distinctive place in the target market's mind' p.175 (Kotler 2001). The dimensions of differentiation that are interesting for the marketing of intermodal road-rail transport based on environmental advantages, are mainly product and image. These will be discussed briefly below.

Starting with the dimension '*product*' in differentiation, it involves transport service differentiation which is relevant in this thesis. It refers to how transport solutions and systems can be designed, where different designs can be offered to various groups of shippers (market segments) based on their requirements and valuation of different aspects of transport services. This can be done by transport providers but also by other actors or stakeholders in society influencing the freight transport market e.g. policy makers. Also, the transport service differentiation may have implications for the transport service development e.g. interchangeable load carriers are needed in order to expand the market for intermodal road-rail transports.

Section 2.3 made a reference to Jensen (2007) that identified the same three strategies as Aaker (that were discussed above) and applied these on intermodal transports in order to make them competitive: cost advantage, differentiation and focus strategies. These are relevant in this discussion of research questions and will therefore be explored further. The proposed strategies are seen in Table 3.1 (Jensen 2007) along with the possible strategy elements supporting the strategies in order to design an intermodal transport system that has a significant, sustainable competitive advantage i.e. a unique combination of properties that allows the system to provide an output with a cost/service ratio that is preferred by customers over the closest competing alternatives.

**Table 3.1 Possible strategy elements of cost advantage, differentiation and focus strategies in transportation**

<b>Cost advantage</b>	<b>Differentiation</b>	<b>Focus</b>
Economies of scale	Transport quality	Spatial segmentation
Economies of scope	<ul style="list-style-type: none"> <li>• transit time</li> </ul>	Customer segmentation
Economies of network	<ul style="list-style-type: none"> <li>• frequency</li> </ul>	Narrow product line
Standardization	<ul style="list-style-type: none"> <li>• reliability</li> </ul>	Unique specialization
Loading factors	<ul style="list-style-type: none"> <li>• goods comfort</li> </ul>	
Resource allocation	<ul style="list-style-type: none"> <li>• security</li> </ul>	
Choice of technology	<ul style="list-style-type: none"> <li>• controllability</li> </ul>	
R & D	<ul style="list-style-type: none"> <li>• flexibility</li> </ul>	
Automation of handling and traffic	<ul style="list-style-type: none"> <li>• detachability</li> </ul>	
Experience	<ul style="list-style-type: none"> <li>• expandability</li> </ul>	
Terminal location	Environmental impact	
Round trip timing	<ul style="list-style-type: none"> <li>• emissions</li> </ul>	
Subsidies	<ul style="list-style-type: none"> <li>• remaining pollution</li> </ul>	
	<ul style="list-style-type: none"> <li>• noise</li> </ul>	
	<ul style="list-style-type: none"> <li>• accidents</li> </ul>	
	<ul style="list-style-type: none"> <li>• land use</li> </ul>	
	<ul style="list-style-type: none"> <li>• energy use</li> </ul>	
	<ul style="list-style-type: none"> <li>• congestion</li> </ul>	
	Marketing channels	
	<ul style="list-style-type: none"> <li>• traditional</li> </ul>	
	<ul style="list-style-type: none"> <li>• internet</li> </ul>	

‘Cost advantage strategies’ can be created in several ways (as seen in Table 3.1) e.g. economies of scale and scope, but the author points out that these are not independent but related to resource utilization of infrastructure and transport units. ‘Differentiation strategies’ can be based on transport quality, environmental impact and marketing channels. Central to the differentiation concept in marketing theory is how the output is perceived and evaluated by the buyers and by regulatory forces influencing output or its production. The buyers of intermodal transports will be shippers in most cases but may also be regulatory public bodies. The most obvious service differentiation is quality, where nine well-known transport quality aspects are mentioned in Table 3.1. Differentiation strategies may also be based on environmental impact (negative externalities) because it is a property that is regulated in various ways of society and the trend is an ambition to convert environmental impacts to economic decision problems for the actors in the market by internalizing external environmental costs to business economic costs. Jensen concludes that environmental impact is a property related to the entire system as such and cannot be ignored. Finally, the role of the ‘focus strategies’ in transport is to strengthen the cost advan-

tage/differentiation combination by offering the output to a set of selected customer segments in the market in order to maximize the significant, sustainable competitive advantage. The author points out that all three strategies will always exist in combination, even if emphasis on both differentiation and cost advantage may result in an average result for both strategies and is difficult to market. In this thesis, the focus strategy with customer segmentation is highly relevant, with emphasis on differentiation based on environmental impact of transport services. This has an effect on differentiated marketing shown in the model of analysis from the theoretical framework, see Figure 2.4.

Also, Reinhardt (1999) proposed environmental product differentiation, see Section 2.5.1, where companies create products or implement processes that offer greater environmental benefits or impose a smaller environmental cost than those of their competitors. This can increase the company's costs, but may also permit the company to raise prices, to gain additional market shares or both. The conditions were: to identify customers that are willing to pay more for an environmentally better product, to communicate the product's environmental benefits credibly and that the company has to protect itself from imitators long enough to profit on its investment. This implies that transport providers offering environmentally preferable transport services e.g. using rail or intermodal road-rail solutions, might have an opportunity to gain market shares from the competitors that do not enhance the environmental aspects in their choice of transport solutions.

Moving on to the dimension '*image*' in differentiation, the potential for marketing of intermodal road-rail transports as an environmentally better alternative falls into the areas of marketing communications. There are several important aspects to consider before a marketing communication program can be formed. The communication process cannot function unless e.g. the decision-makers that are targeted as receivers of the communication are identified. The role of marketing communications in this thesis is as a tool of analysis of the research problem, rather than an output of the results or forming a marketing communication program for intermodal road-rail transports.

The purchasing process when negotiating supply contracts discussed earlier, in Section 2.3.1, is also applicable to companies that purchase freight transports i.e. the shippers. The logistics managers' attitudes towards e.g. environmental aspects of the transport solutions may affect the freight transport buying behavior, and are therefore important to explore. This brings up the problem in studying industrial markets, whether to consider the firm or the individual buyer or manager as the decision-making unit. Webster (1968) believed that both firm

and individual variables must be considered in looking at the firm's objectives, policies, procedures and past experiences as constraints upon the individual buying decision-maker who is also influenced by his/her predispositions. The attitudes of the decision-maker, probably the logistics manager, form part of his/her predispositions. This thesis will concentrate on these attitudes towards the environmental aspects of freight transports.

Starting with 'image', the potential of market them as an environmentally better alternative falls into the areas of marketing communications. There are several important aspects to consider before a marketing communication program can be formed. The communication process cannot function unless e.g. the decision-makers that are targeted as receivers of the communication are identified. In this thesis, the role of marketing communications is a base for identifying various important pre-requisites for marketing communication. It is used more as a tool of analysis of the research problem rather than an output of the results or forming a marketing communication program for intermodal road-rail transports.

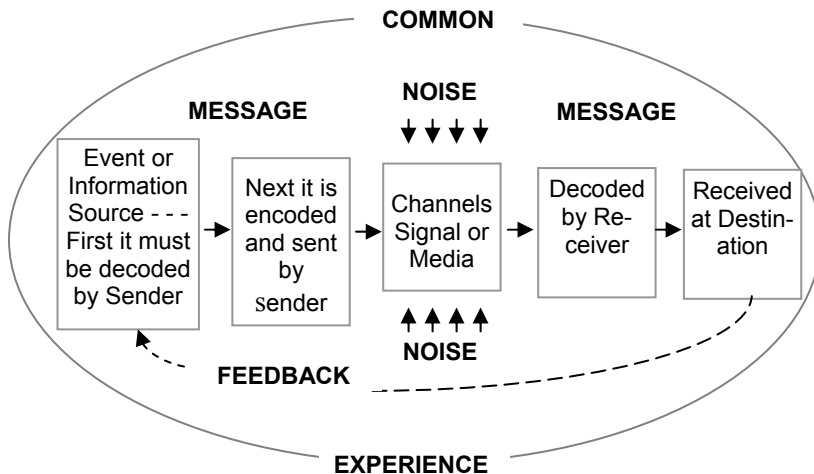
The purchasing process when negotiating supply contracts discussed earlier, in Section 2.3.1, is also applicable to companies buying freight transports, the shippers. The logistics managers' attitudes towards e.g. environmental aspects of the transport solutions may affect the freight transport buying behavior, and are therefore important to explore. This brings up the problem in studying industrial markets, whether to consider the firm or the individual buyer or manager as the decision-making unit. Webster (1968) believed that both firm and individual variables must be considered in looking at the firm's objectives, policies, procedures and past experiences as constraints upon the individual buying decision-maker who is also influenced by his/her predispositions. The attitudes of the decision-maker, probably the logistics manager, form part of his/her predispositions. This thesis will concentrate on these attitudes towards the environmental aspects of freight transports.

The process of service segmentation by Christopher (1992) described above, is similar to the research process in this thesis. The first step involved identifying key components of customer service and was done based on literature, the results of the interview study conducted (see Chapter 5) and from other sources of data collected by colleagues in the research project. The second step involved establishing the relative importance of those service components to customers and was done through the survey (see Chapters 6, 7 and 8). The third step involved identifying "clusters" of customers according to similarity of service preferences; in particular environmental aspects and modal choice. Throughout this thesis, a general ground for segmentation of shippers used is size of com-

pany together with trades of business (see Chapters 6, 7 and 8). Other grounds for further categorization based on the results chapters, are discussed in the conclusions (Chapter 9).

### 3.3 Analysis of research problem using the Communication model

Communication is vital in marketing e.g. the marketing communication models discussed before, see Section 2.3.1. These are based on the widely used communication model which has lasted throughout the years. The steps in the communication process, seen in Figure 3.2, were identified by Shannon and Weaver (1949) but the outer circle was added by Cutlip, Center and Broom (1985).



**Figure 3.2** The communication process

This model can be applied and used as a tool in further analyses of the research problem: to explore the potential of environmental arguments in marketing of intermodal road-rail transports.

#### 3.3.1 Message

In focus are intermodal road-rail transports in Sweden. It is not only a transport service to be sold, but a function. The core service is to transport goods from point A to point B at the right time, but there are other service quality aspects of interest and not in the least how the goods are transported from an environ-

mental point-of-view. This is all part of the message to be sent in the marketing channels.

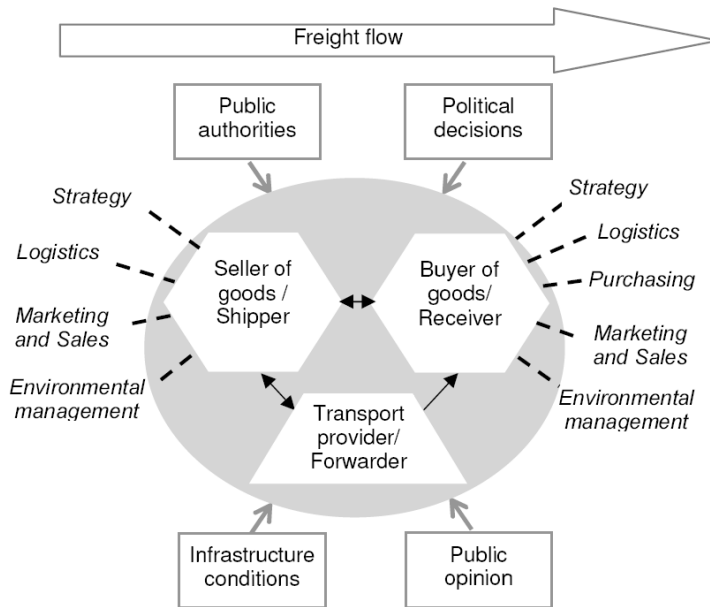
The first consideration to examine is whether it is reasonable to assume that the intermodal road-rail transports are an environmentally better alternative taken the external effects into account. A review of 14 studies regarding external effects of both intermodal and unimodal freight transports (all included both road and rail) was made by Kreutzberger et al.(2003). It clearly showed that intermodal transport has a substantially better environmental performance than unimodal road transport already if only “energy use” and “CO<sub>2</sub>-emissions” are taken into consideration, but even more if including accidents, congestion, noise and local emissions (except SO<sub>x</sub> where intermodal rail transport will only have better performances in case of very favorable conditions). Another exception is when different unfavorable conditions cumulate e.g. very long PPH distances (i.e. pre- and post-haulage distances), shippers’ locations along the main modality route imply a backwards move of PPH vehicles, or electricity production from fossil power plants that are not energy-efficient. The intermodal transport has substantially better environmental performances despite that important effects are excluded from the studies (e.g. water pollution, damage to ecological systems) and spatial scarcity is only partly articulated. However, note that the environmental disadvantages of nuclear electricity production are excluded which would make the environmental gain lower.

It can be concluded that research support the assumption that intermodal road-rail transports are more environmentally efficient than unimodal road transports in a majority of cases. This assumption will guide the work in this thesis. An important question to answer is whether freight transport buyers make a connection between intermodal road-rail transports and environmentally preferable transport services.

### **3.3.2 Senders**

The main actors involved in the transport chain are the seller of goods (shipper) and the freight transport provider (forwarder) who forwards the goods to the buyer (receiver). The choice of transportation mode is made in a complicated behavioral system where certain actors might have an interest in influencing the choice in an environmentally better direction and even be willing to pay for this added value. Their problem might be that they do not know how the product will be transported, the environmental qualities of the transport mode, how efficient influence can be accomplished or what alternative transports are available. In most cases the direct decision when selecting transportation mode is made by

the transport buyer, the shipper, or its forwarding agent but the process that leads to the decision is more likely to be more complicated than that. The transport takes place as a stage in a value-added process where the goods receiver, its distributors/customers and the final consumer all have opportunities, and even motives, to exert influence on the choice of transportation mode. If a company's customers of goods put demands on how the goods are transported, this information is probably received by the marketing and sales function and/or the logistics function. Figure 3.3 proposes a model representing the pre-understanding of the influence processes in the choice of transport solutions.



**Figure 3.3 A conceptual model of the pre-understanding of sources of influence in the choice of transport solutions**

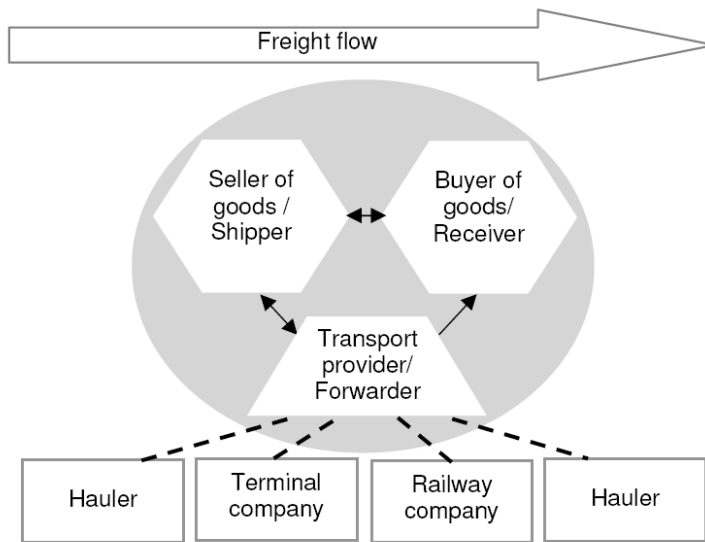
Firstly, there are influences within each company from different functional areas. In the selling company it could be from e.g. environmental management, logistics, marketing and sales and strategy. Influences within the buying company can be from areas e.g. environmental management, logistics, purchasing, strategy and customers. There are also influences between the actors in the transport chain, the grey area in Figure 3.3. Secondly, there are also sources of influence about how the transports are performed from an environmental point-of-view, originating from outside the organizations directly involved in the transport chain. Public opinion is an important factor especially as transports and environmental effects affect the public directly. The political decisions e.g. taxes on diesel are also of influence. This also applies to Public Authorities, e.g.

The National Road Administration, regarding the condition and the location of the infrastructure.

Let us keep the actors in this model in mind and return to the communication model: who would be the **senders** of the message i.e. using environmental arguments in the marketing of intermodal road-rail transports, the marketers? In fact, there are various alternatives. At the *macro-level*, there are various possible actors outside the intermodal transport chain. There is a public interest to decrease the environmental effects of transports and the environment is a common good with external effects. The representatives of the common good, the politicians, have been very clear in their ambitions of increasing the intermodal road-rail transports, as discussed earlier (see Chapter 1). Public authorities within the transport field could be senders, e.g. the Swedish National Rail Administration (Banverket) and the Swedish National Road Administration (Vägverket), but also within the environmental sector e.g. the Swedish EPA (Naturvårdsverket). Politicians interested in this development are of course working on a national level, but there are also regional politicians that want to make their regions attractive for i.e. logistics centers. There are also non-profit organizations e.g. the Swedish Society for Nature Conservation (SSNC) that is in charge of independent eco-labeling scheme regarding transports referred to as "Good Environmental Choice" (SNF 2007). Another NGO is the "Network for transports and the environment", where professionals and researchers in Sweden co-operate in order to reduce the environmental impact of transports e.g. by a compilation of data regarding energy and emissions for freight transports, would be a potential sender (NTM 2005).

Moving on to the *micro-level*, goods are moved in the supply chain from the shipper to the receiver, involving many actors. The actors can be seen as a system, as marketing channels or as a network. Either way, it is important to see who the actors involved are. Various authors have proposed models of the intermodal road-rail system. Jensen (1990) included in his model both the administrative and physical sub-systems. Woxenius (1998) showed in his reference model a synthesized model with classic/technical, network and channel/chain perspectives including; actors, activities and resources. In this thesis, the model in Figure 3.3. will be extended to include actors in the intermodal road-rail transport chain (see Figure 3.4).





**Figure 3.4 Actors in the intermodal road-rail transport chain**

However, the information system and the administrative system are not present in this model, since the aim is for it to be used for identifying actors instead of showing a complete system. When goods are transported between the shipper and the receiver, there is generally a forwarder in the middle. This is a simplified picture in the case of an intermodal transport, as there is normally not only a forwarder but also at least one hauler, a terminal company and a railway company. The shipper is often identical to the transport buyer, as goods are normally sold with the condition that the shipper organize the transport e.g. buys it from a forwarder. The forwarder functions as the coordinator among the intermodal companies.

The intermodal road-rail transport companies have an obvious interest in using environmental arguments in the marketing of these transports if it is effective. At present, the main company selling intermodal road-rail transports in Sweden is CargoNet and they ought to have an interest in increasing their share of the total transport market. The company owns the intermodal road-rail terminals in Sweden i.e. the infrastructure, and allocates the train operations of these transports. Also, forwarders may have an interest in this for relieving the pressure on trucks. An increased demand from shippers for environmentally preferable transport services and/or increased number of rail transports, may offer expanded business opportunities for transport providers.

An important consideration when discussing senders/marketers is to scrutinize what **purpose** each group would have in using environmental arguments in the marketing of intermodal road-rail transports. Those at the micro-level in the intermodal road-rail transport chain all have an economic interest and their goal would be to sell as much of these transports as possible e.g. CargoNet. Those at the macro-level would probably be mainly interested in using the them as a mean to relieve the pressure on road transports and move a higher share to rail, and in that way decrease the total environmental impact of transports. The purpose of the marketing would then mainly be to use the environmental argument when it is environmentally beneficial: to sell intermodal road-rail transports when it is motivated by an environmental gain. Their purposes steer how environmental arguments may be used, and is an important consideration in the marketing communication of intermodal road-rail transports in order to gain credibility.

### ***3.3.3 Channel, signal or media***

In the communication process, what is needed in order to affect the target group and by what means must be examined. This is equivalent to the channel in the communication model.

This will not be focused on in this thesis however, as only the potential of environmental arguments in the marketing of intermodal road-rail transports will be explored. This does not include how these marketing programs may be formed. However, the main marketing communication tools when professional buyers are the target group are personal selling, exhibitions, PR and direct mail (Smith et al. 1997), see Section 2.3.1. The process of revision of supply contracts of transport providers among shippers is vital in organizational buying, and the personal selling is then extremely important. The purchasing process of transports is central in this thesis.

### ***3.3.4 Receivers/ target groups***

Let us move on to examine what would be potential target groups for marketing, i.e. who would be the receivers of the message. This depends of course on who would be the marketers. It is however clear that from a demand-driven view; the shippers play a key role when selecting transport solutions as they are the customers of the forwarders and transport providers. Also, this group is not homogeneous, and there is a possibility of service differentiation, as discussed previous in Section 3.2, based on how the purchasers value different service aspects e.g. environmental considerations and modal aspects. From the perspec-

tive of an individual actor, e.g. the railway operator CargoNet, the target groups would mainly be the forwarders but increasingly also major shippers. If the marketers are at the macro-level, it is still the shippers that form the demand for intermodal road-rail transports, and are thus important. The target group for e.g. public authorities would be politicians that can affect the legislation that would favor intermodal road-rail transports e.g. that each mode pay their own external environmental costs. This study is not from the perspective of individual actors in the transport chain, even if the focus is mainly on the demand among shippers. The whole system in Figure 3.3, including both the macro- and the micro-level, is taken into consideration.

### **3.4 Research questions**

The purpose of this thesis has been described before as: “to explore the potential of using environmental arguments in the marketing of intermodal road-rail freight transports”. Based on my prior knowledge, preliminary research questions were roughly outlined. In addition, the work with the theoretical framework (see Chapter 2) deepened the knowledge base and additional marketing literature helped in analyzing the research problem (see Section 3.3). The conducted explorative interview study (see Chapter 5) contributed to generating ideas and identifying key issues with regards to transports and environmental considerations among those responsible for shippers’ logistics function. All of these theoretical and empirical findings were part of the research process and contributed to better defining the research questions. These are shown in Table 3.2, together with more specific knowledge needs identified which are necessary in order to explore the research questions.

**Table 3.2 The defined research questions and identified knowledge needs**

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<b>Research questions</b>	<b>Knowledge needs</b>
1. What impact do environmental aspects have on shippers and their customers?	<ul style="list-style-type: none"><li>• Investigate to what extent environmental measures are considered and integrated among shippers.</li><li>• Explore if there are any pressures for environmental considerations of transports present in the supply chain.</li></ul>
2. If environmentally preferable transport services are offered, are they value-adding to the shippers?	<ul style="list-style-type: none"><li>• Explore how important environmental aspects are, along with other aspects such as price and service qualities, when freight transports are purchased.</li><li>• Explore the possibility of preferences of environmental aspects changing in the future.</li></ul>
3. Is it effective to use environmental arguments in marketing strategies of intermodal road-rail transports?	<ul style="list-style-type: none"><li>• Explore the link between environmental aspects and modal choice among shippers.</li><li>• Explore if any segmentation of shippers can be made based on environmental concern and modal choice.</li></ul>

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The identified knowledge needs took the research questions down to a more operational level. Apart from the knowledge needs identified above, additional basic data were needed as input in order to make a marketing analysis regarding intermodal road-rail transports e.g.:

- Description of the freight sent in terms of volumes, distances, destination etc.
- Infrastructure for intermodal transports at shippers.
- Use of different transport modes.
- Identification of decision-makers of transport modes and transport providers at shippers.
- Relations with transport providers in terms of contracts.

The next step was the choice of data collection methods. This will be discussed in the following chapter, where this choice also will be related to the research questions (see Section 4.2).

## 4 Methodological considerations

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### 4.1 Choice of research design

A research design is the framework or plan for a study used as a guide in collecting and analyzing data. Churchill and Iacobucci (2002) propose three types of marketing research designs: exploratory, descriptive and causal research. The exploratory research is used mainly in the discovery of ideas and insights, whereas the descriptive research is used when determining the frequency with which something occurs or the relationships between variables (often guided by an initial hypothesis). The explorative approach is flexible and qualitative, whereas the descriptive approach is more rigid and quantitative. The causal research involves determining cause-and-effect relationships e.g. by experiments, which was not applicable for the purpose of this thesis. The approaches best suited are exploratory and descriptive research, and are thus used in the research process in this thesis. The next question is what methods to use in each approach. The methods that may be used in exploratory research are; literature review, experience survey (key informant interviews), focus groups (group interviews) and selected case studies (Churchill and Iacobucci 2002). In descriptive research, the studies can be longitudinal (a fixed sample of elements is measured repeatedly) or cross-sectional (a sample of elements of interest is measured once). The cross-sectional study is equivalent to a sample survey. The explorative methods chosen in this thesis were key informant interviews in combination with a literature review (see Chapter 2), or it may also be defined as a light version of a case study. The next step was a descriptive research study in the form of a survey. It is relevant to look more into detail at the different approaches.

Traditionally, there have been conflicting views on research between a survey researcher and a case study researcher, or between a quantitative and a qualitative approach. However, there are researchers that aim to take advantage of both

regimes and use different methods in their research. Ragin (2000) has for example developed a diversity-oriented research in order to find a middle path between the two methods. The advantage of choosing different research methods is to get a better and diversified picture, since each method has both advantages and disadvantages. It is useful though to look at the differences as methods, even if what is said about case study research can easily be applied to all types of exploratory research. The case-study researcher's goal is to show how the aspects mutually constitute the whole case and then to compare the different wholes. A survey researcher by contrast studies one or a small number of dependent variables across a large number of cases and tries to identify a set of variables that explains as much variation as possible in the dependent variables. In sum, the comparative case-study research is deep but not wide (i.e. "intensive"), whereas the survey research is the opposite: wide but not very deep (i.e. "extensive") The case-study researcher primarily applies the principle of complexity whereas the survey researcher applies the principle of generality (Ragin 2000). If multiple data collection methods are used, then triangulation may be achieved, which provides a stronger substantiation of constructs and hypothesis in research (Eisenhardt 1989). The various methods in this thesis complement each other and the use of these provide a diversified picture of the complex reality the actors live and act in.

There is another commonly used categorization of possible research approaches; deductive and inductive. Deductive approaches are concerned with developing propositions from current research and testing them in the real world. In inductive approaches, theory is systematically generated from data. A more recent third approach is the abductive one (Alvesson and Sköldbberg 1994) where the "need" for theory is created in the process. A closely connected one is the systematic combining approach proposed by Dubois and Gadde (2002) which is based on abduction; "a process where theoretical framework, empirical fieldwork, and case analysis evolve simultaneously". The authors stress that it is particularly useful for the development of new theories. Also, if the researcher constantly goes "back and forth" between empirical observations and theory, he/she is able to expand the understanding of both of them since none of them can be understood unless the other one is.

The systematic combining approach provides a good description of how the research process in this thesis was formed going back and forth between theory and collection of empirical data; literature reviews have been made in parallel to the data collection. Regarding the collection of empirical material, it was evident early on that the demand for environmental aspects of freight transports would be explored in relation to other qualities. In this way, environmental considerations in decision-making situations among shippers were not isolated. In

order to succeed in this, it was vital to consider what methods to use when collecting data. As mentioned before, the process involved both exploratory and descriptive research. The first empirical study involved explorative, semi-structured interviews that were carried out in transport-buying companies among persons in charge of logistics, environmental work or marketing in order to find out about environmental issues in relation to freight transports. It was an inductive approach. In fact, it was through these interviews the research questions (see Section 3.4) were better formulated. These interviews gave a picture of how the transport buyer thought when negotiating with transport providers. After this study, a second empirical study was initiated by using a telephone-initiated mail survey among transport buyers, conducted along with two other members of the intermodal road-rail transport research program<sup>23</sup>. Parts of the survey covered environmental considerations of freight transports, and also in association with other aspects important to the shippers e.g. service and price, in order to answer the research questions defined.

## 4.2 Research questions and data collection

In this thesis, the research questions guided the information that needed to be collected i.e. the knowledge needs displayed in Table 3.2. In fact, a previous less mature and less detailed version of these knowledge needs guided the explorative interview study initially. However, the research questions were refined and slightly modified after the insights and ideas were generated from the explorative research. The onward data collection was designed so that these knowledge needs would be satisfied in the best possible way. The information needed was therefore further broken down into variables, which made these knowledge needs tangible. Then a suitable data collection method was chosen in order to operationalize each of the identified relevant variables, and a telephone-initiated survey method was chosen. This process is illustrated in Table 4.1 which can be considered as a continuation of Table 3.2, and provides a picture of how the empirical material was collected.

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<sup>23</sup> Along with Bernt Saxin and Jonas Flodén at the School of Business, Economics and Law, Göteborg.

**Table 4.1 Knowledge needs broken down into variables and data collection methods used**

Knowledge needs	Specification of Variable Categories	Data collection methods
<p>➤ Investigate to what extent environmental measures are considered and integrated among shippers.</p>	<ul style="list-style-type: none"> <li>• EMS</li> <li>• Environmental policy</li> <li>• Environmental department</li> <li>• Environmental education</li> <li>• Support from senior management</li> <li>• Co-operation between functions internally, with suppliers and transport providers</li> <li>• Various environmental measures of transports</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews</li> <li>• Survey</li> </ul>
<p>➤ Explore if there are any pressures for environmental considerations of transports present in the supply chain.</p>	<ul style="list-style-type: none"> <li>• Pressures from customers</li> <li>• Pressures from own organization</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews</li> <li>• Survey</li> </ul>
<p>➤ Explore how important environmental aspects are, along with other aspects such as price and service qualities, when freight transports are purchased.</p>	<ul style="list-style-type: none"> <li>• Trade-offs with price, transport time, on-time delivery and environmental aspects</li> <li>• Environmental demands on freight transports</li> <li>• Impact of environmental policy on transports</li> <li>• Evaluation of various service dimensions and price</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews</li> <li>• Survey</li> </ul>
<p>➤ Explore the possibility of preferences of environmental aspects changing in the future.</p>	<ul style="list-style-type: none"> <li>• Possibility to implement various environmental measures</li> </ul>	<ul style="list-style-type: none"> <li>• Survey</li> </ul>
<p>➤ Explore the link between environmental aspects and modal choice among shippers.</p>	<ul style="list-style-type: none"> <li>• Evaluation of environmental aspects</li> <li>• Evaluation of modal choice</li> </ul>	<ul style="list-style-type: none"> <li>• Survey</li> </ul>
<p>➤ Explore if any segmentation of shippers can be made based on environmental concern and modal choice.</p>	<ul style="list-style-type: none"> <li>• Size</li> <li>• Evaluation of environmental aspects</li> <li>• Amount of freight sent</li> <li>• Transport distances</li> <li>• Infrastructure at shippers</li> <li>• Internal and external pressures</li> </ul>	<ul style="list-style-type: none"> <li>• Survey</li> </ul>



### 4.3 Design of exploratory interview study

The general objective in exploratory research is to gain insights and ideas. This is especially helpful in breaking broad problem statements into smaller, more precise sub-problem statements (Churchill and Iacobucci 2002). In the beginning of the research process, there is a lack of sufficient understanding of the problem to formulate specific hypothesis, and therefore the exploratory research is characterized by flexibility in terms of methods used. Literature search is one type of exploratory research, which was used in this thesis. Analysis of selected cases is another type, where exploratory interviews are very helpful in gaining insights in order to develop further research questions. A light version of a case study approach was adapted in the exploratory interview study, which is especially appropriate when the research question asked is formed as a “how” or “why” (Yin 1994). In the exploratory study, the purpose was formed as: “how (and why) do companies work with environmental considerations in connection to their freight transports”.

The purpose of a qualitative research interview research interview is described by Kvale (1996) as “to obtain descriptions of the world of the interviewee with respect to interpreting the meaning of the described phenomena” (pp. 30-31). He sets up a dozen characteristics of a qualitative research interview, or a checklist, which have guided this study (in his own words):

- *Life World*. The topic is the everyday lived world of the interviewee and his/her relation to it.
- *Meaning*. The interview seeks to interpret the meaning of central themes in the life of the subject. The interviewer registers and interprets the meaning of what is said as well as how it is said.
- *Qualitative*. It seeks qualitative knowledge expressed in normal language; it does not aim at quantification.
- *Descriptive*. It attempts to obtain open nuanced descriptions of different aspects of the subject’s life worlds.
- *Specificity*. Descriptions of specific situations and action consequences are elicited, not general opinions.
- *Deliberate Naiveté*. The interviewer exhibits openness to new and unexpected phenomena, rather than having ready-made categories and schemes of interpretations.
- *Focused*. The interview is focused on particular themes: it is neither strictly structured with standardized questions, nor entirely “non-directive.”
- *Ambiguity*. Interviewee statements can sometimes be ambiguous, reflecting contradictions in the world the subject lives in.

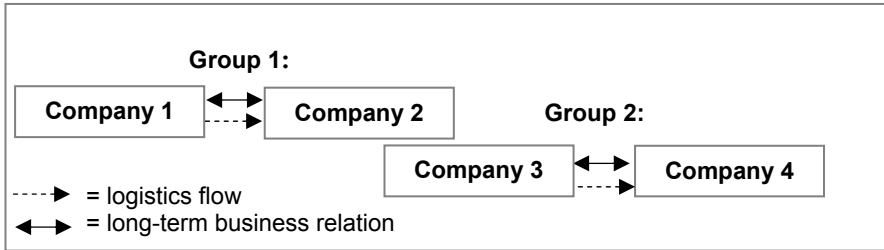
- *Change*. The process of being interviewed may produce new insights and awareness, and the subject may in the course of the interview come to change his/her descriptions and meanings about a theme.
- *Sensitivity*. Different interviewers can produce different statements on the same themes, depending on their sensitivity to knowledge of the interview topic.
- *Interpersonal situation*. The knowledge obtained is produced through the interpersonal interaction in the interview.
- *Positive experience*. A well carried out research interview can be a rare and enriching experience for the interviewee, who may obtain new insights into his/her life situation.

The interviews were conducted with these characteristics in mind in order to raise the quality of the results.

Again, the purpose of the study was to describe how and why companies work with environmental considerations in connection to their freight transports. This meant that there were certain areas of interest relevant to discuss in the interviews in order to get an understanding and description of this work. In the interview guide used, a set of core areas were covered: the company's business, its transports, demands from stakeholders, purchasing of transports, the company's environmental work and freight transports in the future. The interviews conducted were semi-structured in order to combine the advantages of the standardized and non-standardized interview; the interviewer is required to ask specific questions but is free to probe beyond them if necessary. The interview guide was also semi-structured (see Appendix 2) in order to gain as much insight as possible about the logistical decisions and environmental concerns. It contained about 35-40 questions but it was not standardized e.g. there was no strict order of issues discussed and it was possible to use follow-up questions. The emphasis in each interview was dependent on the informant's function. The design was exploratory, but some comparisons were possible. Annual and environmental reports formed part of the background information. All interviews were transcribed and analyzed. The results of the study were also reported in a paper (Lammgård 2004).

In this conducted explorative study, companies of various sizes were included to achieve different perspectives. The process of the selection of companies was initialized by the choice of one company, known for its work with environmental issues. The logistics managers at the company named three important customers or suppliers, and one of them was selected for interviews. The purpose of choosing companies in established business relations was to track the pressures for environmental considerations.

The interviews were conducted among four companies divided in two groups with a business relation in each, see Figure 4.1.



**Figure 4.1** The position of companies studied in the supply chains.

One group contained a pulp company and a producer of paper. The second group consisted of a producer of consumer and industry products along with one of the major food delivery companies in Sweden. In sum, three of the selected companies manufacture products based on forest materials and the fourth is a food retailer. Nine interviews took place in the study and there were one to three interviews at each company, see Table 4.2.

**Table 4.2** Number of conducted interviews in Companies 1 to 4

Function of informant	Company 1	Company 2	Company 3	Company 4
Logistics	1	1	1	1
Environment		1	2	
Marketing	1			
Senior Management	1			

The results of the interview study will be discussed in Chapter 5.

#### **4.3.1** *Validity and reliability of exploratory study*

A common critique of case study research is that the results are not generalizable since only a limited number of cases are included, in contrast to a survey research with a sample that makes it easy to generalize to a larger population and thus has high external validity. However, Yin (1994) states that this is not correct since case studies do not rely on statistical generalization but on analytical generalization and he proposed that instead of generalizing one case from to another, an analyst should try to generalize findings to “theory”. In this thesis, this was done through the generation of a proposed model based on the inter-

view study, see Figure 5.2. Kvale (1996) noted that there are several examples in psychology where a few single cases made it possible to obtain general knowledge and to make generalizations – it all depends on the purpose. The purpose of the interviews conducted in this thesis was to create knowledge, and generate ideas and input for the survey construction including its items. This last mentioned purpose is discussed in Section 4.4.2. The traditional, positivistic view assumes that there is a quest for universal knowledge, which in a post-modern approach is replaced by an emphasis on the heterogeneity and contextuality of knowledge; a shift from generalization to contextualization according to Kvale (1996). He argues that verification is not a separate stage of an investigation but should be addressed throughout the entire research process.

Validity in ordinary language is concerned with the truth and correctness of a statement, and in research it is concerned with how well the method investigates what it is intended to investigate (Kvale 1996). Again, postmodern thinking regards knowledge as a social construction of reality, instead of a mirror of reality, where truth is constituted through dialogue (Kvale 1996). The craftsmanship and credibility of the researcher becomes essential. Also, when ascertaining validity, the question of “what” and “why” needs to be answered before the question of “how”; the content and purpose of investigation precedes the method.

Reliability pertains to the consistency of the research findings and issues of reliability are present during the whole process; interviewing, transcribing and analyzing (Kvale 1996). One example of interviewer reliability is in relation to leading questions which may inadvertently influence the answers. There is a fine balance regarding the reliability of interview findings: increasing it is desirable in order to counteract haphazard subjectivity but a strong emphasis on reliability may counteract creative innovations and variability (Kvale 1996). Also, the reliability of the interviewer i.e. how consistently the researcher carries out the task, is of critical importance and training of the interviewer will increase the reliability (Keats 2000). During the interviews conducted, the same topics were often addressed more than once in order to control the answers given earlier of the respondent but sometimes from a slightly different angle. Also, I believe my background and experience as a trained journalist, has contributed to improving the quality of the interviews and therefore the reliability. I was the only one giving the interviews. Yin (1994) recommends making as many steps as operational as possible in order to increase the reliability, so that the results can be checked by another person. In the exploratory study, the use of a semi-structured interview guide, the recording of all interviews, the transcription and the coding by themes increased the reliability of the results.

A central theme in this thesis is environmental considerations and this brings a certain ethical component. This implies that whatever method is chosen, the ethical component has to be taken into consideration and the potential impact this will have on the results needs to be analyzed. The purpose of the interviews was of course to obtain information from the interviewee, but it must be clear to the researcher that the information is accurate. It is known that people can lie, say things intended to put them in a good light, try to avoid offending others etc., which can lead to bias in the information gathered (Ackroyd and Hughes 1992). A certain distortion of information from interviewees can also be plausible, as she/he wants to give an image of oneself as an environmentally conscious person, or regard the participation in the study as a way of marketing the company. At a personal level, it could be e.g. hard to admit that one does not know so much about the company's environmental management as he/she should.

The disadvantage is the limited time of an interview and during that time it is extremely difficult to see if the interviewee is really describing his/her work and thoughts in a proper way. Now, this does not necessarily mean that the interviewee will consciously lie, but information can be distorted unconsciously. There is often a difference between what people say they will do and what they actually do. Individuals may express strong support for certain topics in an interview, but in real-life situations they may act "inconsistent" with those beliefs and attitudes (Ackroyd and Hughes 1992). This is a weakness of the method and a challenge to the interviewer. In the interviews conducted, the intuitive feeling was that the interviewees expressed their opinion. On the contrary, especially one logistics manager expressed very strong resistance to persons at the environmental department and their work i.e. he did not try to put himself in a good light from an environmental point-of-view.

#### **4.4 Design of survey**

After the exploratory study was conducted, more specific research questions were formulated (see Section 3.4). The process left the exploratory research phase and the descriptive phase was initialized; a cross-sectional, descriptive study. Descriptive studies are more rigid than the exploratory studies, and require a clear specification of the *who*, *what*, *when*, *where*, *why* and *how* of the research (Churchill and Iacobucci 2002). These authors point out that a researcher will only be able to specify these questions after some labored thought, a small pilot study or an exploratory study. Aside from other minor studies (discussed below in Section 4.4.2), the results of the above described exploratory

interview study (see Chapter 5) was mainly the foundation of the conducted survey, especially concerning the environmental issues included.

During a survey, there are important considerations to begin with such as establishing the types of scales to use, choice of statistical measures and methods, and the identification of the effects of error and uncertainty (in particular frame errors, measurement error and non-response error which are discussed further on). When the results of a survey are presented, most academic papers or reports do not go into detail of the process. However, it is clear that the process of carrying out a survey and the choices made will greatly affect the outcome as well as the validity. The next sections will therefore attempt to describe this process in a way that highlights the barriers that had to be overcome on the way.

The plan for survey design can be divided into eight steps, which is based on a fusion of different categorizations (Churchill and Iacobucci 2002; Cochran 1977; Scheaffer et al. 1990). These steps are; (1) Research questions, (2) Definition of variables, (3) Definition of elements, (4) Definition of target population of survey, (5) Design of measurement instrument, (6) Choice of frame, (7) Sample design, (8) Non-response problem and (9) Data analyses. This section is presented according to this classification. The first two points relate to the purpose of survey and have already been discussed; the research questions have been dealt with (see Table 3.2) and also the definition of variables (see Table 4.1). The remaining points will be discussed below, although the definition of elements (3) and target population of survey (4) are presented together in the following section.

#### ***4.4.1 Definition of elements and target population (Steps 3+4)***

The survey was carried through in collaboration with members of the thematic research program “Systems for Combined transport between Road and Rail” at the School of Economics, Business and Law at Göteborg University; Bernt Saxin and Jonas Flodén. The purpose of the study was “to increase the knowledge on how cost efficient and environmentally efficient freight transports with high delivery precision should be designed in the future”. It was conducted during year 2003 among manufacturing and wholesale companies in Sweden, which were our population.

Initially, the frame to be used in a survey must be decided on. A frame is a list of sampling units, which in turn are non-overlapping collections of elements from the population that cover the entire population (Scheaffer et al. 1990). An element is an object on which a measurement is taken (Scheaffer et al. 1990).

The frame chosen was the Statistics Sweden's Business Register (SCB 2004), which contained a total of 13,325 local units. The 'local unit' was our defined element in the survey conducted. The term local unit is not equal to a company as many companies have more than one local unit (but an active company must have at least one local unit). An additional local unit for the company exists if the location (1) has some activity (2) is in a geographically defined unit (i.e. a separate address), (3) is permanent for some period of time and (4) have employees (SCB 2004). We chose to use local units instead of companies, as one aim of the survey was to locate the transport flows geographically. The register also classifies each local unit according to one or several industry codes<sup>24</sup>. The register has different sized classes based on the number of employees, which were used as a basis when we divided the companies into strata at a later stage (see Section 4.4.4). In the thesis, the term 'companies' will be used when referring to local units.

The survey aimed at freight transports within, or originated from, Sweden. Since the common interest in the thematic research program is combined (intermodal road-rail) transports, our main target was freight transports that could carry potential freight for this combination of transport modes. Therefore, we wanted to exclude local, and to some extent also regional, transports and decided to set a limit at a reasonable distance. It was decided that the target population of the survey was to be active companies having outbound freight transports exceeding 150 km. Those having only transports shorter than 150 kilometers were excluded. Therefore, the distances up to 150 kilometers are included as a separate category when the results are presented.

#### **4.4.2 Design of measurement instrument (Step 5)**

The next step in the process was to design a valid and reliable measurement instrument. A useful and common method of data collection is the self-administrated mail questionnaire. On one hand, it does not require e.g. interviewers, which can keep the survey cost down. On the other hand, this method has the least contact with the respondents, and therefore it frequently has the lowest rate of response (Scheaffer et al. 1990). The possibility of obtaining complex data, which can be used for multivariate analysis etc. when analyzing different aspects, is another advantage with a mail, or survey, questionnaire. However, the measurement instrument is not only a question about the survey

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<sup>24</sup> The activity of a company or a local unit respectively is described by a five-digit code according to Swedish standard industrial classification (SNI), which is based on the EU standard NACE. An enterprise or a local unit can be coded with several codes depending on the activities' contribution to turnover or their part of worked time (SCB, 2004).

questionnaire to be used, but it is possible to consider the respondents as a part of the measurement instrument. It is the respondent that reads and processes the information in the survey questionnaire, and after some reflection hopefully answers the questions asked. The step with the design of measurement instrument therefore involves further issues that are necessary to be considered in detail; (1) the choice of respondents, (2) the design of items and questions, and (3) the survey questionnaire itself.

**Firstly, the choice of respondents** had to be established. The mail survey targeted outbound transports bought or managed by the local units of wholesale and manufacturing companies in Sweden. The persons responsible for the purchasing of transports at the local units were judged as being the respondents best suited for answering the survey. At the same time, there was the risk of obtaining a low response rate due to the use of a mail survey method. Our main problem to confront was: how to increase the response rate on a mail survey and at the same time increase the validity. We decided that by putting more effort into identifying the right respondents and initiating personal contact by telephone before sending out the mail survey, the response rate would increase as well as the validity of the results. So, the survey conducted used a self-administrative mail questionnaire as a basis, but in addition it was extended to this telephone-initiated survey method, which was also reported in Lammgård et al (2004).

**Secondly, the design of survey items and questions** was elaborated and a great deal of work was put into the survey construction. There was collaboration with both internal researchers within the Logistics and Transport Research Group and external ones. There were considerations taken into account on how previously used questionnaires in the research group, as well as in external surveys had been formulated. Two smaller pre-studies were carried out by members of the intermodal road-rail research program; the explorative interview study discussed earlier (see Section 4.3) and a telephone-based interview study among logistics managers about aspects of their freight transports by Bernt Saxin. The final draft of the survey questionnaire was tested as an informal pilot study by a number of logistics managers in industry.

The selection of items included in the survey questionnaire is relevant to discuss. The conducted explorative interview study was important for this purpose. In this study, various important factors contributing to the environmental considerations on shippers' transport decisions were identified and proposed (see Figure 5.2). This next step was to study these factors on a larger scale and measure their importance in a survey study. In the elaboration of the survey



questionnaire, these results helped in identifying and defining the items to be included. These will be discussed more in detail next.

One influential factor identified in the logistical decision-making was the transport context, especially the freight flows and geographical aspects. Quite a few questions covered this factor in the survey but the ones relevant for the context of my research questions concerned freight volumes, length and destinations of freight transports, but also modes of transports used and the infrastructure that certain modes require at the shippers (see Sections 6.1.1-6.1.4). The results also showed that there existed certain trade-offs between environmental aspects and other business aspects. Some of the most frequently mentioned aspects were: price, on-time deliveries, price, trust, goods damages, time frequency, IT, invoicing routines, train solutions, easy to deal with, geographic coverage etc. These aspects were included in a question where the respondents were asked to attribute weight of importance to 31 listed items when selecting transport providers in the survey (see Table 6.9 and Table 8.1 for results and Appendix 4 for survey question).

There were also items relating to environmental aspects added to this question in the questionnaire. These were based on aspects that came up in the interviews and on the evaluation forms of transport suppliers recommended by NTM e.g. modal choice, coordinated freight flows, empty loads, trucks in high environmental classes, alternative fuels and implementation of ISO 14001. Another question included in the survey measured the trade-off between environmental aspects and other aspects. The most commonly mentioned aspects in the interviews were on-time deliveries and price (see Table 5.2). Transport time and reliability in addition to price/transport costs have proven to be important in prior research (Hopkins et al. 1993; Morash and Ozment 1996; SIKA 2000a). This affected the choice of factors included in the survey when the respondents were asked to distribute 100% among four factors according to their importance when their local unit selects transport solution for their outbound transports: price, transport time from door-to-door, on-time delivery from door-to-door and environmental efficiency represented by CO<sub>2</sub> emissions (see Section 6.4 for results and survey question 9 in Appendix 3).

The interviews gave further input to a question relating to the importance of different measures for reducing environmental effects of the respondents' freight transports (see Table 7.1 for results and survey question 30 in Appendix 3). In the interviews, the discussion about environmental work brought up internal environmental pressures including implemented systems and tools e.g. EMS, environmental policy, and environmental reports. Additional, separate

questions about the implementation of EMS and environmental policy were included in order to achieve a type of triangulation with the question about measures. The role of the environmental department was very important for the work at the logistics departments and led to aspects such as projects of co-operation between the environmental department and the logistics department, environmental education, support from management in environmental issues. The factor identified in the proposed model of the interview study named external environmental pressures covered co-operation with customers, suppliers and demands put on transport providers for inbound and outbound transports etc. These were brought up in the interviews with the logistics managers in addition to the aspects mentioned above which led to the inclusion of questions regarding pressures from customers and the own company (see Table 7.7 and Table 8.7 for results, and survey questions 27 and 28 in Appendix 3).

Apart from the explorative interview study, there were naturally implications from theory and prior studies in transport research (some are discussed before in Section 3.1) also supported the items included in the questionnaire (Björklund 2002; Evers et al. 1996; Laitila and Westin 2001; McGinnis 1990). Research on purchasing also brought up important aspects, for example the long-term impact of relations but also short-term aspects such as financial, service, social and information aspects in the Interaction model (Håkansson 1982). Relational, social and informational items were included in the survey in the question relating to the choice of transport provider. Also relational aspects such as prior experience of supplier and that the supplier has a good reputation were included, which came up in a few interviews and also has proven to be important in research, see e.g. Murray and Cupples (2001).

In sum, the interview study helped in many ways as input to the elaboration of the survey questionnaire (especially regarding the questions relating to the environmental considerations of freight transports), but also theory. In addition, the pre-study by Bernt Saxin mentioned earlier identified many common important aspects as in this interview study, which increased the validity of the items included.

***Thirdly, the survey questionnaire*** was the result of the work with the elaboration of the survey items and questions. The survey gave a picture of the demand. On one hand, it covered the transport pattern of the core service – the actual transport – today (e.g. background facts of company, transport volumes, transport modes used, transport relations, transport costs, transport contracts, time precision). On the other hand, it also contained questions about the extent to which transport buyers evaluated different aspects of logistic services (e.g.

delivery time, price, service, environmental aspects), and how these aspects are met in their current situation. The survey contained 30 main questions, but when including sub-questions and attitudes towards various items, there was a total of 155 questions (see Appendix 3 for the survey questionnaire). It took about 25-60 minutes to answer the survey, depending on the statistics available.

It was necessary to choose a rating scale for the part of the survey that aimed at measuring the respondent's attitudes and opinions. Attitudes have been in focus especially in social-psychology research. There is a relation between attitude on the one hand and beliefs and intentions on the other. A person's attitude toward an object is related to his beliefs that the object possesses certain attributes and his evaluations to these attributes, according to Fishbein and Ajzen (1975). Similarly, attitude is related to the set of a person's behavioral intentions with the respect to an object, each intention weighted by its evaluative implications. Opinions have been considered in research as verbal expressions of attitude and that they may therefore be used to measure attitude (Fishbein and Ajzen 1975). Most attitude-scaling procedures arrive at an attitude score on the basis of a person's responses to a set of such opinion items. These items are statements of belief or intention, and the person's response indicates his/her location along a probability dimension; i.e. it is a measure of the strength of his/her belief or intention. According to classical test theory, a person's response to a given item is composed of a "true" score reflecting the underlying dimension (in this case his/her attitude) and some measurement error (Fishbein and Ajzen 1975). However, these errors cancel each other out as the number of items increases, and the sum or average across all items is thus a more accurate reflection of the "true" attitude. All standard attitude scales use multiple-item formats. The self-report technique is by far the most common approach, in which people are asked directly for their beliefs or feelings toward an object, activity, or class of objects, used in many types of attitude scales (Churchill and Iacobucci 2002).

There are various types of rating scales and one of them is the numeric rating scale which is used in summated-rating attitude scales (others include checklists, forced-choice instruments, category or graphic rating scales) (Kerlinger and Lee 2000). The four general categories of scales are; nominal, ordinal, interval and ratio. Many marketing scales used possess no more than interval measurement and some even less (Churchill and Iacobucci 2002). A nominal scale permits only identity, while an ordinal also allows ordering. In addition, an interval scale makes it possible to compare the intervals between the numbers and thus the differences. Finally, a ratio scale also possesses an absolute or natural origin.

One numeric rating attitude scale is the Semantic differential scale; it measures people's reactions to stimulus words and concepts in terms of ratings on bipolar scales defined with contrasting adjectives at each end e.g. good-bad (Heise 1970). However, the use of these scales in marketing studies (e.g. by developing profiles for brands etc or total scores by which the objects could be compared) has tended to follow the Likert approach to scale construction rather than the semantic differential tradition (Churchill and Iacobucci 2002). The Likert scale is the most commonly used attitude scale. It is a bipolar scaling method, measuring either levels of "agreement" to the item stimuli, but it can also be other terms used e.g. "satisfaction", "preference", or "likelihood" (Desselle 2002). Traditionally a five-point scale is used, but also a seven- or nine-point scale. A total score is obtained by summing the responses to each stimulus, and subtotals can be obtained for various components or domains of the scale uncovered through a factor analysis procedure. These subtotals may be treated as interval data measuring a latent variable. Otherwise, responses to a single Likert item are normally treated as ordinal data, especially when using five levels, as one cannot assume that respondents perceive the difference between the levels as equidistant. However, there is some debate about whether to treat semantic differential or Likert data as interval or ordinal data, but the most common posture in marketing has been the interval scaling approach (Churchill and Iacobucci 2002).

In the conducted survey, the respondent had to evaluate a statement on a closed-ended seven-point attitude scale of the semantic differential scale type. The bipolar adjectives used were 'small' – 'large'. The attitude scales relied mainly on interval scales, although whole numbers were to be used (1-7) when the respondents were asked e.g. to rate importance of various attributes already discussed above (when selecting transport provider and regarding possible environmental measures). In one question however, a ratio scale was used; the respondents were asked to distribute 100% among four factors according to their importance when their local unit selects transport solution (as discussed above). There are some possible distortions of responses though to keep in mind; the respondents may avoid using extreme response categories (central tendency bias) or may try portraying themselves in a more favorable light (social desirability bias). These biases are difficult to calculate though.

It must be emphasized that this 9-page mail survey was very extensive and the respondents were asked for detailed transport statistics divided on several destinations, time periods etc., which required data collection and statistics. Of course, we understood that this would strongly influence the response rate in a negative way. One option discussed was to break up the survey into two, e.g. the environmental aspects of transportation could have been a separate survey in

itself. However, the option with one larger survey was chosen and instead the intention was to increase the response rate by putting more resources into the collection phase. The main reason for choosing this alternative was the possibility of establishing relationships and to, for example, make multivariate analyses if everything was included in one questionnaire. In order to find out if environmental considerations are taken into account in a purchasing situation, it was important to analyze what balances are made between the various attributes.

In order to make the survey process manageable, and at the same time efficiently access and store information, a computer database was designed by Bernt Saxin. The data collected by us were gradually fed into this database in a user-friendly environment, but also data from Statistics Sweden's Business Register (see Section 4.4.1). Mainly three researchers worked in the collection phase and all activities performed were entered into the database, e.g. each telephone call made to business units including a short summary of outcome, reasons for not participating, mail survey and reminders sent. All data input were automatically coded with date and time i.e. a type of research diary.

#### **4.4.3 Choice of frame (Step 6)**

This step involves the choice of frame, but also identifying and solving the frame problems that arose while conducting this survey. It is crucial that the frame represents the target population and this is a problem when there is a difference between the two that need to be solved in the best possible way. The risk of an incomplete frame always exists, but by using the Statistics Sweden's Business Register (SCB 2004) which is updated continuously, this risk was minimized. A random, stratified sample (which is discussed further on in Section 4.4.4) was made with a total of 1,800 local units out of the total of 13,325 in the register. When conducting a survey using simple random sampling, there are several frame problems to confront. According to Kish (1965), there are four basic frame problems: missing elements, clusters of elements, blanks or foreign elements, and duplicate listings. All of these problems may affect the possibility of choosing elements from the target population with known probability. In the survey sample, we wanted the same probability within each stratum. We confronted the frame problems with clusters of elements and foreign elements.

The frame problem with *clusters of elements* is present when one selected element contains several elements of the target population. One method that can be used if the clusters are not too large and too frequent is to measure all elements hiding behind the selected elements and to include all of them in the sample.

This makes the sample larger but this is not a disadvantage (Kish, 1965). In the survey, there was a sample of local units where some only had administrative functions locally, but had warehouses (that were not listed as local units) with physical transports. This fact that one local unit could hide several units at different locations, resulted in a cluster of elements in our frame. This was primarily solved by getting the respondent at the local unit to answer one questionnaire for each sub-unit. Therefore, all elements within each stratum had the same probability of selection.

The frame problem with *blanks or foreign elements* is present when there are elements in the frame that are not in the target population and it is necessary to eliminate these elements from the sample. First of all, a correction had to be made when the sampled local units were contacted and it turned out that some did not exist anymore due to e.g. bankruptcy (often small-sized local units). These were considered as foreign elements in the frame. In addition, all local units that did not have transports exceeding 150 kilometers were also considered as foreign elements. This frame problem also existed in other cases that we did not foresee. An example of foreign elements found within manufacturing companies was in the sub-sector of publishing and printing of newspapers. The local units of newspaper companies' editorial offices were coded as manufacturing companies (since it is the content that is being produced); however, the physical transport is generated by the local units printing the newspaper. Therefore, the editorial offices were excluded from the frame whereas the printing units were allowed to remain in the frame. In addition, many examples were found where the central head office for a manufacturing company group (often located in Stockholm) was recorded in the frame as a wholesale company but the rest of the local units were recorded according to their business e.g. manufacturing of an industry product. As the head office did not have any transports as an administrative unit, it was excluded as a foreign element.

In order to solve sampling problems, we developed principles in situations that required special attention. Some of the principles are discussed below. As mentioned before, the origin of a physical flow is not always the same place geographically as where the local unit is located, nor where the transport is bought. An example of this type of situation is when the transports are outsourced to a Third party logistics provider (3PL), so that the goods are distributed from an outsourced stock. This affects the results when analyzing the answers divided by strata. If the 3PL answers the questionnaire on behalf of a middle-sized company, then the answers probably will differ from other middle-sized companies, since the freight volume transported is larger for the 3PL. Another example is when the transports are managed from a central stock, located at a geographically different location than the local unit in the sample. In cases like

this, contact was established with the stock facility. All those considerations have to be taken into account when the results are analyzed according to local unit size or geographical location etc. since they may not be representative for their strata. In some cases, a central function of the mother company was in charge of buying all freight transport for a group of companies. Then, the questionnaire had to be divided into two parts, where the questions regarding the flows of freight were answered locally at the local unit whereas the questions addressing criteria when purchasing transports were answered at the central function. The primary focus was kept on a local level but the purchasing criteria are many times formed centrally in the company. Also, all transports are often managed at this central unit.

Another problem confronted was in cases where large companies also controlled and purchased their inbound transports, although this was not a frame problem but rather a matter of identification of the proper respondent. The consequence for the survey was that some of the sampled local units had outbound transports but these were ex-works flows i.e. the buyer of goods paid and managed the transport. The decision-maker was therefore not at the local unit, but at another company. Since these flows can be substantial e.g. for suppliers to the car industry, they were followed up by contacting the buyer of the goods i.e. the transport buyer. In this way a separate stratum was created dealing with ex-works flows that could be later integrated with the rest of the collected data.

All types of information about how the work was divided within and between companies came to our knowledge in the phone calls made in search for the proper respondents i.e. as partial result of the telephone-initiated method applied. The aim of adapting these principles was to ensure that the respondent answering the survey had knowledge of the transports, so the survey answers collected would be reliable.

#### **4.4.4 Sample design (Step 7)**

The sample design involves the type of sampling processes applied in order to obtain a sample i.e. a collection of sampling units drawn from a frame (Scheaffer et al. 1990). Two of these are stratified sampling and double sampling, which were used in this thesis.

**Stratified sampling** is used when the population can be divided into non-overlapping groups (strata) where the variation within the strata is less than the variation within the entire population. The advantages, according to Kvanli et al (1996) are that it is possible to obtain: (1) more information from the sample as

data are more homogenous within each stratum and hence, the confidence intervals are narrower than those obtained through random sampling, (2) a cross-section of the entire population, and (3) an estimate of the mean within each stratum as well as an estimate of the mean for the entire population. In the conducted survey, we chose to use stratified sampling in order to be able to make estimations of each stratum as well as of the whole population.

**Double sampling**, also referred to as two-phase sampling, is a way of selecting the basic sample of  $n$  elements not directly from the population of  $N$  elements, but from a pre-selection of a larger sample of elements (Kish 1965). Ancillary information from the larger preliminary sample is used to improve the final sample of  $n$  elements. This was done in the conducted study after it had been established what local units were in our target population i.e. had outbound transports exceeding 150 kilometers.

As mentioned before, the frame was Statistics Sweden’s Business Register (SCB 2004) which contained a total of 13,325 local units. SCB had classified these into groups based on number of employees, which also determined our classification of strata: small-, medium- and large-sized local units in manufacturing and wholesale companies respectively (see Table 4.2).

**Table 4.2 Strata based on number of employees at local units and industry code**

Industry code	Number of employees		
	<i>Small-size</i>	<i>Medium-size</i>	<i>Large-size</i>
Manufacturing	10-99	100-399	400-
Wholesale trade and commission trade	5-19	20-99	100-

We applied a double sampling procedure. In the first step, there was a simple stratified random sample (Phase 1 sample) drawn from the frame, consisting of a total of 1,800 local units. The large-sized companies included all existing large-sized companies in Sweden; 178 wholesale companies and 242 manufacturing companies. In the rest of the strata, a sample of 345 local units was drawn by SCB (see Column B in Table 4.3).



**Table 4.3 Total units in Sweden, respectively in target population, and contacted for survey**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>Stratum</b>	<b>Frame</b> (Total local units in Sweden) <b>N</b>	<b>Phase 1 sample</b>	<b>Number of local units in target population in Phase 1 sample</b>	<b>Estimated total local units in Sweden in target population</b> <b>N'</b>
Small manufacturing	3,503	345	221 (64%)	2,244
Small wholesale	6,711	345	174 (50%)	3,385
Medium manufacturing	970	345	280 (81%)	787
Medium wholesale	1,721	345	213 (62%)	1,063
Large manufacturing	242	242	222 (92%)	222
Large wholesale	178	178	131 (74%)	131
<i>Total</i>	<i>13,325</i>	<i>1,800</i>	<i>1,241</i>	<i>7,832</i>

After this, we had to find out the proportion of units in the sample that was in our target population in each stratum. All local units in the sample were contacted by telephone to determine whether they had outbound freight transports exceeding 150 kilometers or not, and if they were active. In this way we could determine exactly which elements in our sample were in the target population and how many were foreign elements; 107 local units did not exist anymore due to e.g. bankruptcy and some local units did not have these transports. The latter were discarded. Finally, the stratum sizes in the frame (Column A) were multiplied by the sample proportions of units belonging to our target population (Column C), which gave us estimated stratum sizes of the target population (Column D).

In the second step, a stratified random sample from the Phase 1 sample was made (i.e. the Phase 2 sample). These selected units were personally asked to participate in the mail survey. Two considerations determined the sample sizes in the different strata:

- In three strata (medium- and large-sized manufacturing local units, and large-sized wholesale local units), most local units had a substantial amount of transports. We therefore decided to include all local units in these strata from the Phase 1 sample.
- In the remaining three strata (small- and medium-sized wholesale local units, and small-sized manufacturing local units), a large proportion did

not have any transports, or only local distribution less than 150 kilometers (as described above). About 85% of those that did (and were therefore in our target population) in these strata was selected.

**Table 4.4 Estimated target population in Sweden, and Phase 2 sample**

<b>Stratum</b>	<b>Estimated target population</b>	<b>Phase 2 sample (=Contacted in target population)</b>
Small manufacturing	2,244	183
Small wholesale	3,385	148
Medium manufacturing	787	279
Medium wholesale	1,063	192
Large manufacturing	222	221
Large wholesale	131	131
<i>Total</i>	<i>7,832</i>	<i>1,154</i>

This resulted in a random, stratified sample<sup>25</sup> with a total of 1,154 local units in our target population that were contacted for the survey and belonged to the Phase 2 sample (see Table 4.4). In sum, by applying this method in the sampling process the sample sizes were arrived at through double sampling.

#### **4.4.5 Non-response problem (Step 8)**

A major problem when conducting a survey is how to deal with the lack of response. This section discusses what efforts were made in order to reduce the non-response (and thus raise the response rate) i.e. non-response prevention, and how the non-response problem was handled.

There were various measures for raising the response rate taken in the conducted survey, which were quite far-reaching. A hand-signed, personal introduction letter from Professor Arne Jensen of the Logistics and Transport Research group was included in the mail survey (see Appendix 3). An initial test with a few hundred surveys sent directly without prior personal contact to some of the smaller local units (addressing the person in charge of transports) was done in order to test the response rate. The outcome of this test was a response rate of about 10% and this confirmed our suspicion that the survey was too time-consuming that respondents would answer it without further efforts from

<sup>25</sup>There was a simple, random sample within each stratum.

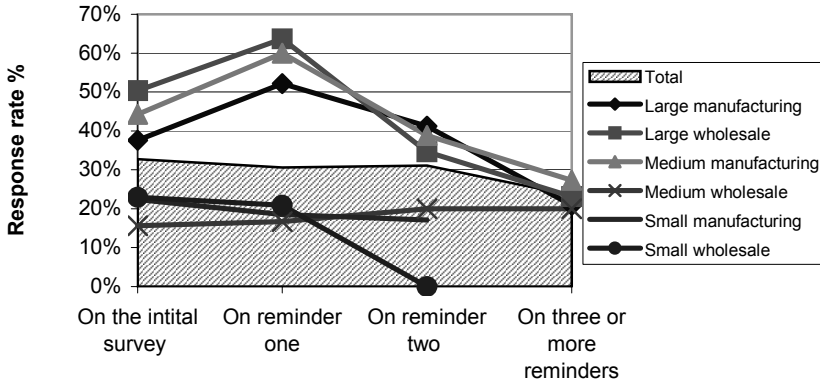
our side. Also, we learned later when the proper respondents were phoned up and identified, that these surveys often had not reached them at all.

Instead, we began making telephone calls to the local units, in order to identify the persons in charge of the outbound freight transport. The work of finding the proper respondent for each local unit was quite hard. The first contact in almost all large and middle-sized companies was with the telephone exchange of the company. After asking for the logistics/transport manager or someone in comparable position, the connecting of the phone calls was normally not correct. Either the person answering was just a receiver of goods at the factory floor, or working within other areas. Often, the telephone operator did not know of anyone having this job or similar job tasks. In addition, the person to whom we were connected was often not available to answer the phone call – many times in a meeting. It often took more than 2-3 phone calls to talk to a person, and it often turned out to be the wrong person anyway. The result was that every local unit in the sample demanded many phone calls.

Once located, the e-mail address and/or cellular phone number were noted which helped later on in the process of reminders of the mail survey. There were only two local units that we did not manage to get in contact with despite several attempts (more than 8). Finally, aside from identifying the proper respondent, the advantage with the initial phone call was that it gave useful background information of the transport situation and how the logistics function was organized within the local unit, as well as within the company. Also, this information helped us understand the complexity of the problems of reliability of the answers received when conducting a survey study.

A vital purpose of the phone calls was at the psychological level, as the respondents promised to help our research by filling in the questionnaire to be sent. The cultural setting in Sweden is often that “a promise is a promise”. Therefore, it would have offered resistance not to comply with this promise. It happened that respondents asked us to phone them up again to remind them if the questionnaire did not arrive within the following weeks. If it happened that the questionnaire was not sent back and time went by, then more reminders were used. This was done through written reminders, e-mails, and phone calls. When the respondents were phoned, they often felt bad about not having answered the questionnaire. Note that a small share of the contacted units in our target population, equal to 3% (37 local units), turned down answering the survey upon the initial phone call and therefore did not even receive the first survey by post. Most of these were among the small- and medium-sized companies. A majority, 86%, said that it was due to lack of time.

The effect of the initial survey sent out (always initiated by a personal telephone call where the respondent agreed on participating in the survey) was more effective than the second reminder sent out, as seen in Figure 4.2. The graph shows the response rate on each individual mailing, i.e. the number of questionnaires that were returned in relation to the number of mailings performed.



**Figure 4.2 Response rate upon each mailing (not cumulative).**

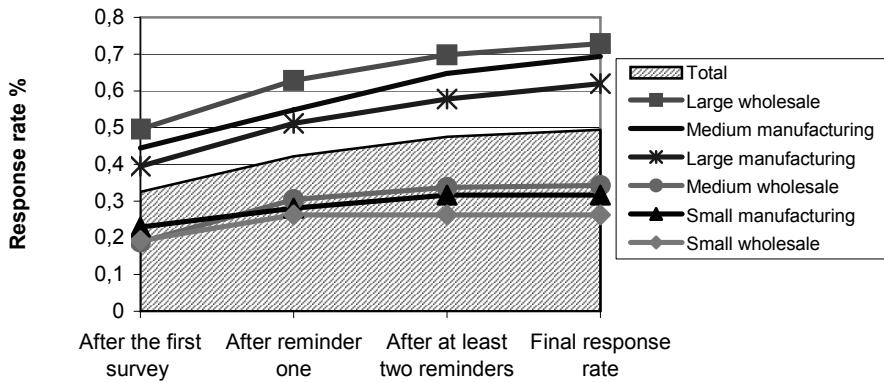
Reminder one gave the best overall effect among all mailings carried out in the large-sized companies as well as in the medium-sized manufacturing companies. The reminders in general had less impact on the response rate among the smaller companies, and for the medium-sized wholesale companies. Fewer reminders were sent out in these strata due to their relative small share of the total transport volume. Also, the effect of three or more reminders was decreasing rapidly (with the exception for the medium-sized wholesale companies), so the work of reminding respondents was put to an end. Note that the down-sloped curve showing the effect of reminder two among the small-sized wholesale companies is based on only a few cases. However, it can be concluded that reminders, not surprisingly, do affect the response rate in a positive way.

Beforehand, a concern was that the respondents would be annoyed by getting many phone calls and reminders. Few respondents contacted at the local units did not want to participate when they were initially contacted, even though this amount increased after a few reminders, as some local units realized then that they could not find the time to answer the questionnaire. Time was in general the most common reason for not answering the survey as the questionnaire took about 20-50 minutes to fill in, depending on what available statistics the working place had. This was especially the case for the smaller companies and the response rate was lowest in these groups, 32% (see Table 4.5). A probable explanation is that these companies have low volumes of freight transported and therefore do not put major effort into collecting data about their transports.

**Table 4.5 Effect on response rate for each mailing sent out, final response rate and total number of contacted in target population**

Stratum	Initial mailing	Reminder one	Reminder two	Final response rate	Number of responses	Contacted in target pop. for survey
	%	%	%	%		
Small manufacturing	23	17	17	32	58	183
Small wholesale	19	19	0	32	48	148
Medium manufacturing	44	66	39	66	183	279
Medium wholesale	19	18	24	29	55	192
Large manufacturing	39	53	41	59	131	221
Large wholesale	50	74	35	70	92	131
<i>Total</i>	32	41	26	49	567	1,154

A visual presentation of the cumulative response rate per stratum can be seen in Figure 4.3.



**Figure 4.3 Total cumulative response rate based on activities performed.**

The final response rate was 49% but if this figure is adjusted by excluding the small manufacturing and wholesale companies, then the final response rate was 56% (where 63% was in the manufacturing companies and 46% in the wholesale companies). An important fact is that the largest companies in the two groups got a 63% response rate and about the same percentage is also achieved if the medium-sized manufacturing companies are included (64%). These three groups of companies have the largest volumes of freight transported (about 98% of total transported freight stated in the survey, measured in ton equivalent weight) and therefore the major efforts to get the surveys sent back were made

in these groups i.e. highest number of contacts by telephone and mail. The reward for this work is shown in the high response rates for these groups.

A few examples from surveys in transportation research (with corresponding response rates) will be mentioned here as a comparison to the response rate obtained in the conducted survey. Bardi et al (1989) mailed a survey to 1,000 transportation executives on CLM<sup>26</sup>'s membership list mapping determinants of modal choice (response rate: 29%). Harper and Evers (1993) mailed 695 executives in logistics of manufacturing firms, with more than 50 employees, about shippers perceptions of modes (response rate: 22%). A study of the role of transportation in supply chains was made by Morash and Clinton (1997) and was sent out to 9,634 firms in USA, Japan, Korea and Australia (response rate: 20%). Hopkins et al (1993) mailed a survey to 950 shippers and carriers about service quality gaps (response rate: 16%), and SIKa (2000a) did a Swedish survey on a similar issue sent out to 85 persons (response rate: 38%). It can be concluded that the response rates rarely reached more than 30% in surveys carried out in transportation research, and usually about 20-25%. In comparison to these studies, the response rates reached in the conducted survey can be considered as high.

#### **4.4.6 Data analyses (Step 9)**

When the survey questionnaire was constructed, some of the planned data analyses were outlined in order to facilitate this step. An example was the attitude questions measured with closed-ended 7-point intensity scales, which were suited for factor analyses. The main statistical analyses methods used when analyzing the survey results were two Confirmatory factor analyses, two paired samples t-tests, two correlation analyses and a chi square test for independence. All analyses were conducted in SPSS.

The central aim of factor analysis is to represent or explain observed covariational relations among many experimental variables in terms of linear dependencies on, and relations among, a much reduced number of "ideal", or "latent" conceptual variables, according to Cattell (1988). The author believes that factor analysis is one of the most direct, universally applicable, and representative of scientific methods. It is advantageous to use when the variables examined are numerous. In this thesis, principle components analyses (PCA) were conducted followed by a Varimax rotation, where the original variables are transformed

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<sup>26</sup> CLM=Council of Logistics Management, but has changed name to the Council of Supply Chain Management Professionals (CSCMP 2005).

into a smaller set of linear combinations. Preliminary analyses were previously performed to ensure that no violation of the assumption of normality, linearity and homoscedasticity occurred.

The results of the two factor analyses conducted are presented in the results chapters. The first one (see Table 7.5) was based on a question where the respondents were asked to attribute weight of the importance to 18 measures for reduction of the environmental impact of their transports. The other factor analysis conducted (see Table 8.1) was based on a question where the respondents were asked to attribute weight of the importance to 31 items relating to the transport provider and the transport offer. Stewart (1981) pointed out that factor analysis may play an important, and perhaps essential role in the definition of types or dimensions of a data set, that can then be used for further analyses aimed at identifying segments. A Kaiser-Meyer-Olkin measure of sampling adequacy, MSA, provides a measure of the extent to which the variables belong together and are thus appropriate for factor analysis (Stewart 1981). Over .9 can be considered marvelous but above .6 can be considered recommended (Kaiser and Rice 1974). The Bartlett's test of sphericity is another statistical test for the presence of correlations among the variables and it is widely used when examining how many factors to extract (Hair et al. 2006). Two others are the latent roots criterion, where eigenvalues greater than 1.0 can be considered significant, and the Scree test criterion (Hair et al. 2006; Stewart 1981). The use of a combination of approaches is recommended (Stewart 1981) and over-factoring by one or two factors has less severe consequences for the final solution than if too few factors are chosen. All these tests were conducted and supported the suitability of the factors extracted in these analyses.

When it comes to the rotation problem, the choice is between orthogonal or oblique rotation methods. An orthogonal one is useful in order to reduce a larger number of variables to a smaller set of uncorrelated variables, which can be used subsequently in further analysis (Hair et al. 2006), and an orthogonal Varimax rotation was chosen. However, both rotation methods were tried as Stewart (1981) recommends in order to identify the simpler structure. After the rotation, the factor loadings in the factor matrix are analyzed. Hair et al (2006) suggests that the loadings of the factors should be at least greater than +/-0.40 and are significant only for sample sizes of 350 or greater. The sample size in the conducted factor analyses was greater than 499. In the results of both factor analyses, see Table 7.5 and Table 8.1, all loadings higher than 0.40 on a factor were shown. An item was attributed to the factor it loaded the highest on. Sensitivity analyses were conducted in both factor analyses as firstly, a factor analysis was done on all responses obtained in each question and secondly also with an imputation of each stratum's average substituting missing values. The same

factors were extracted both times, resulting in the same factors and gave the same factor result.

Based on the first factor analysis, the respondents were also asked to attribute weight of the possibility for implementation of the same 18 measures for reduction of the environmental impact of their transports using the same scale (see Table 7.5). In relation to the second factor analysis, the respondents were also asked to indicate to what degree their current transport provider(s) fulfilled each of these 31 items relating to the transport provider and the transport offer used in the factor analysis, using the same scale (see Table 8.4).

After both factor analyses, summated scales were created. These are formed by combining several individual variables into a single composite measure i.e. all variables loading highly on a factor are combined and the average scores of the variables are used as replacement variables (Hair et al. 2006). Hair et al put forward two benefits in particular by using summated scales. First, it is a way of overcoming to some extent the measurement error. This error is the degree to which the observed values are not representative of the actual values due to a number of reasons e.g. actual errors (data entry errors) but also the inability of respondents to accurately provide information. Thus, the summated scale reduces measurement error by using multiple indicators (variables) to reduce the reliance on a single question. Secondly, the summated scale can represent the many aspects of a concept in a single measure.

Paired t-tests were used with these summated scales for each factor in order to identify gaps in each of the two analyses i.e.; (1) the gap between the importance and the possibility for implementation of measures for reduction of the environmental impact of their transports (see Table 7.6), and (2) the gap between the importance and the satisfaction with items relating to the transport provider and the transport offer (see Table 8.4).

Correlation analyses were conducted (see Table 8.3 and Table 8.8) using Pearson correlation tests, where interval data were used. Chi-square test for independence was conducted and in order to see the strength of the relationship, the Phi measure of association was also conducted (see Table 8.7). The Phi was used as it was a 2-by-2 table formed by true dichotomies.

Before the results are presented, there are issues of reliability and validity that need to be addressed.



#### 4.4.7 Reliability of survey study

There are various possible sources of errors that may occur during a survey study, which affect the reliability. These matters will be discussed in this section. As discussed before, the factor analysis method is used in this thesis and therefore their results as summated scales are evaluated in terms of reliability.

A source of error can be classified as either a sampling or a non-sampling error. A first theme of interest is the potential *sampling errors* that may arise because the data are collected from a part  $n$ , rather than the complete population of  $N$ . However, these errors decrease with increases in sample size (Churchill and Iacobucci 2002). The sampling process was described in Section 4.4.4, where the sample sizes were arrived at through stratified, double sampling. This sample survey design has mainly three major advantages (Scheaffer et al. 1990); (1) the variance of the estimator of the population mean is usually reduced because the variance of observations within each stratum is usually smaller than the overall population variance, (2) the cost of collecting and analyzing the data is often reduced by the separation of a large population into smaller strata, and (3) separate estimates can be obtained for individual strata without selecting another sample and, hence without additional cost.

In this thesis, firstly a stratified random sample from Statistics Sweden's Business register was used, a correction of some frame problems in the sample was done, and the target population was identified. Secondly, a stratified random sample from the sample from Statistics Sweden was made. In addition to the double sampling process, a few sampling problems arose that made us develop principles in these situations that required special attention, as discussed earlier in Section 4.4.3. The aim of adapting these principles was to ensure that the respondent answering the survey had knowledge of the transports. In this way, the validity (which is discussed more in the following section) became better than if the mail survey would have been sent out without identifying the respondent in advance. At the same time, there was a risk by adopting principles and by introducing an element of personal judgment from our side, based on the information given in the phone calls, which might affect the reliability in a negative way. Finally these risks were evaluated and assessed as being inferior when compared to situations in which those principles had not existed at all. The use of double sampling and the telephone-initiated method reduced the risk of sampling errors.

Aside from the sampling error associated with the process of selecting a sample, are the *non-sampling errors*. These can be random or non-random i.e. system-

atic. The random errors are the unpredictable errors resulting from estimation but these are generally cancelled out if a large enough sample is used, just as in the case of the sampling errors (Churchill and Iacobucci 2002). In this case, the sample can be considered as large and also the received answers (n=567). The systematic errors are those that tend to accumulate over the entire sample and tend to bias the sample value away from the population parameter (Churchill and Iacobucci 2002). However, they are extremely difficult to measure statistically but are very important to discuss in terms of validity.

The sources of non-sampling error in a survey are according to Cochran (1977):

- Failure to measure some of the units in the chosen sample e.g. some individuals are not located or respondents' refusal to answer the questions when they are located.
- Errors of measurement on a unit due to biased or imprecise measuring device e.g. the respondents do not possess accurate information or give biased answers.
- Errors in editing, coding and tabulating results.

Alternatively, Churchill and Iacobucci (2002) divides the non-sampling errors into non-observation errors (corresponds to the first theme of Cochran) and observation errors (corresponds to the second and third theme by Cochran). Another way of categorizing it is by saying that non-sampling errors may occur because of problems in coverage, non-response, response, data processing, estimation and analysis (Churchill and Iacobucci 2002; Statistics Canada 2006). These will be discussed here.

*Coverage errors* occur when there is an omission (undercoverage), duplication or wrongful inclusion (overcoverage) of the units in the population or sample. The telephone-initiated survey method helped in discovering and correcting this as we obtained updated and correct information directly from the units during the telephone calls. The survey frame was controlled in this way, as discussed in Section 4.4.3.

There are a few issues relating to the problem of *non-response errors*. This is a failure to obtain information from some of the elements of the population that were selected and designated for the sample, and it is problematic as it raises the question of whether those who did respond differ in some important way from those who did not respond (Churchill and Iacobucci 2002). The two main sources of non-response bias are unavailability and refusals. In the conducted survey, all 1,156 local units selected for the survey were contacted and asked to

participate in the survey, with the exception of two! These were given up on after at least eight attempts of contact. It is needless to say that this required many phone calls. All practical problems in the data collection phase of finding respondents and especially the time involved in solving these problems were initially underestimated. Therefore, the collection phase was prolonged to approximately 10 months in total. This was although not a major problem for the results since they did not include any longitudinal information.

The problem with refusal was also somewhat present in the study, when the respondents were located and phoned. A few methods, of which the majority also are found in literature (Churchill and Iacobucci 2002), were used for handling this. There were attempts to convince the respondent of the value of the research, anonymity was guaranteed since only aggregated statistics were produced so that no individual company could be identified, a personalized cover letter from Professor Arne Jensen was enclosed with the survey, and the telephone calls were used to draw the respondents' attention to the survey. The follow-up telephone calls were also used to persuade those respondents that did not answer at first. The personal contact with the respondents during this telephone-initiated survey method made the commitment of answering the questionnaire stronger. In one case, a respondent even called only to excuse himself for not answering the survey as he had promised, because the person he needed the information from had died a few days earlier. His commitment to his promise was not in doubt.

The most common reason for not answering the questionnaire was lack of time or statistics. The response rate in smaller companies (32%) was also much lower than in the medium- and large-sized working places (56%), which probably more commonly had specialized functions working exclusively with transports. This seemed to be the case especially for the largest companies (63%). Looking at these larger companies and comparing our study with other international studies, it can be concluded that 63% is a very high response rate, particularly considering the very complex questionnaire used.

*Response errors* result from data that have been requested, provided, received or recorded incorrectly and may occur because of flaws of the questionnaire, the interviewer, the respondent or the survey process (Statistics Canada 2006). One potential source of concern is poor questionnaire design. The design of the questionnaire used in the conducted survey was discussed in Section 4.4.2. The validity of the survey questionnaire can be considered high. The items included were based on the exploratory study discussed earlier in Section 4.3, but also on an additional pre-study by another member of the research team that conducted

the survey, Bernt Saxin. A pilot study was also conducted and additional input was found in theory.

Other types of response errors are due to the respondent (e.g. providing incorrect answers) and to the survey process itself (e.g. lack of control over the survey procedures). These two sources of response errors were dealt with in the conducted survey mainly through the contact by telephone, where notes about the transports etc. were taken and entered into the database (that could be compared to the response of questions if necessary) and questions in the questionnaire could be explained further if the respondent had any problems giving correct answers. However, this naturally does not entirely eliminate the possibility of the respondent giving false statements, but this risk is very difficult to control in all data collection processes.

The other sources of problems relating to non-sampling errors are *data processing* (e.g. wrongly coded data), *estimation* and *analysis* (e.g. when preliminary results are used instead of the final ones). These problems can be referred to as field and office error (Churchill and Iacobucci 2002). The response errors described above can also be classified as a potential field error. In order to prevent other field errors, a few measures were taken: a discussion between the researchers before the telephone calls about the instructions with the purpose of study well-defined. Also, the office errors relating to coding, tabulating, or analyzing the data were counteracted by going over the database thoroughly together in the research team, mainly myself and Bernt Saxin. Also, a codebook that lists the codes for each variable and the categories included in each code was put together. There were also different data methods used for the same analysis e.g. in the factor analysis, as discussed in Section 4.4.6.

**Reliability** assesses the similarity of results provided by independent yet comparable measures of the same object, trait or construct i.e. a variable (Churchill and Iacobucci 2002) . It may also be defined in three different ways (Kerlinger and Lee 2000):

- In terms of stability/dependability/predictability (if the same sets of objects are measured repeatedly with the same measuring instrument, will the results be the same?),
- As a lack of distortion (are the measured obtained from a measuring instrument the “true” measures of the property measured?),
- By asking how much error of measurement (random errors) there is in a measuring instrument.

So far, the error of measurements has been dealt with partly. There are several options available for measuring reliability, and among the most commonly used ones are test-retest and internal consistency (Ejlertsson 2005). This is in line with Hair et al (2006) that suggest that consistency can be measured between the responses of an individual at two different points in time, or to use Cronbach’s alpha which is the most widely used measurement for testing internal consistency i.e. consistency for the entire scale. The possible range of value is from 0 (no correlation between items) to 1 (the items are identical), but the most recommended lower limit in literature is 0.7 (Hair et al. 2006). However, it is also considered by some as an arbitrary rule with no evidence to support it, and therefore most authors of measurement textbooks do not set such a value (Kerlinger and Lee 2000). There may also be theoretical or practical reasons for a lower limit. Another way of measuring internal consistency is measurements relating to each separate item; item-to-total correlation or inter-item correlation. In this thesis, Cronbach’s alpha is used as a measure of consistency in the summated scales (i.e. factors) extracted from two factor analyses.

The first factor analysis was based on the attributed importance of different aspects for the choice of transport provider (see Table 8.1 for factor analysis). The Cronbach’s alpha value of each summated scale is shown in Table 4.6. The factors relating to Basic aspects, Environmental aspects and Modal aspects all showed a coefficient value of 0.7 or higher. These factors are mainly in focus for the purpose of this thesis. The three factors IT and additional logistics services, Relational aspects and Loading/Volume had somewhat lower values but exceeded 0.6. These last three factors were retained since they were important to use in comparison with the first three factors. The factor *Price* showed a very low coefficient value between the two items included and therefore, the individual items ‘Price’ and ‘Geographic coverage’ were used instead of a summated scale of this factor in the subsequent analyses (see Table 8.2).

**Table 4.6 Reliability coefficient by Cronbach's alpha for importance of factors in the choice of transport provider**

<b>Summated scales</b>	<b>Factor</b>	<b>Number of items</b>	<b>Cronbach's alpha</b>
Scale 1	Basic aspects	11	0.84
Scale 2	Environmental aspects	5	0.88
Scale 3	IT and additional logistics services	3	0.65
Scale 4	Modal aspects	4	0.70
Scale 5	Relational aspects	3	0.63
Scale 6	Loading / Volume	5	0.62
(Scale 7)	Price	2	0.16

The second factor analysis was based on the attributed importance of different measures relating to the environment (see Table 7.5 for factor analysis). The Cronbach's alpha value of each summated scale in Table 4.7 showed that all five scales had a high internal consistency; ranging from 0.83 to 0.92.

**Table 4.7 Reliability coefficient by Cronbach's alpha for environmental measures**

<b>Summated scales</b>	<b>Factor</b>	<b>Number of items</b>	<b>Cronbach's alpha</b>
Scale 1	Intra-organizational measures	7	0.91
Scale 2	Inter-organizational measures	4	0.89
Scale 3	Outbound transports	3	0.83
Scale 4	Modal choice	2	0.92
Scale 5	Load factors	2	0.88

Thus, reliability is the lack of distortion or precision of a measuring instrument. It is possible to have reliability without validity, but not the other way around (Kerlinger and Lee 2000). Reliability is a prerequisite for measurement validity. Validity is discussed in the next section.

#### **4.4.8 Validity of survey study**

In general terms, a survey is valid when it measures what it is supposed to. In more specific terms, a scale that has been assessed as meeting the necessary levels of reliability must also be examined in terms of validity. If a measure is valid, it reflects the characteristic that it is supposed to measure and is not distorted by other factors, neither systematic nor transitory (Churchill and Iacobucci 2002). There is no error, neither systematic nor random, and the results represent the true score of the object on the characteristic measured

(Churchill and Iacobucci 2002). However, the relationship between score and true score is always inferred and the bases are; (1) direct assessment employing validity, and (2) indirect assessment via reliability. The reliability has already been discussed and also the sources of errors relevant to the conducted study. Also, summated scales are evaluated in terms of validity. Note firstly as a general comment that there is no one validity, and a test or a scale is valid for the scientific or practical purpose of its user (Kerlinger and Lee 2000).

The performance of a survey instrument can be measured in several types of validity, where one categorization is; face, content, criterion and construct (Litwin 1995). Litwin includes *face validity* (although this form is often excluded since it is regarded as the least scientific form of validity) and it is a casual review of how good an item or group of items appears by individuals with no formal training in the subject under study. Face validity is similar to *content validity*, but the judges used in this latter form have expertise in some aspect of the subject. In the conducted study, drafts of the survey questionnaire were tested on many persons and the items included were therefore refined and improved gradually. It was tested on a few, untrained persons but it was mainly tested on other researchers and practitioners in the logistics field. These researchers belonged to the Logistics and Transport Research Group, but also external ones at Chalmers University of Technology in the intermodal research program. The practitioners worked with logistics in companies and had the “everyday insights” of various aspects of their freight transports. The *criterion validity* is how consistent the measure is with what we already know (in comparison to “gold standard” measures of the same variable i.e. concurrent validity) and what we expect (how well the survey instrument forecasts future events, behaviors, attitudes or outcomes i.e. predictive validity). This is done through calculating correlation coefficients. In the conducted survey, these validity concepts were not applicable since there was not one established and accepted gold standard in transport research, neither was it possible to make a second survey to compare the first one with.

Finally, the *construct validity* is the most difficult way of assessing a survey instrument (Churchill and Iacobucci 2002). It concerns how meaningful the scale or survey instrument is when in practical use and is not often calculated as a quantifiable statistic (Litwin 1995). Normally construct validity is determined after years of experience by numerous investigators and it can be either convergent (where several different methods for obtaining the same information about a given concept produce similar results) or divergent (a survey instrument must not correlate too closely with similar but distinct concepts). The conducted survey was carried out mainly by PhD students, but we had experienced researchers at an arm’s length. The supervising Professor Arne Jensen, has a long ex-

perience of constructing and conducting surveys. PhD Peter Rosén has also carried out surveys in the logistics and transport research field and he assisted in the construction of the survey questions. Altogether, the experience of the persons in the nearby research environment helped considerably in raising the construct validity to a higher level. Results from some of the conducted tests can be used to evaluate the convergent validity. A Pearson's test of correlation was conducted between the importance of environmental aspects when selecting transport solution, and the weight of Factor 2 "Environmental aspects" from the factor analysis showing the importance when selecting transport provider to the shipper (See Table 8.3). These two different variables showed a statistically significant correlation which supports that they relate to the same concept of 'environmental aspects'. Another indication of the convergent validity was shown regarding the very high correlation between the factors Modal aspects and Environmental aspects (see Table 8.8).

This section started out with a discussion of sources of errors. It must be emphasized that the total error, rather than any single type of error, is the key (Churchill and Iacobucci 2002). In the conducted survey, the telephone-initiated survey method affected the response rate in a positive way and also gave a better understanding of the data collected. If we would have used a traditional survey method, i.e. just sending out the questionnaires addressed to the "logistics manager", we would have been unaware of what the answers actually represented, e.g. a group of companies, outsourcing or foreign elements. The risk of errors decreased as a result of the work of identifying the respondents most suitable for answering the survey in advance and by adopting some principles to follow. In this way, the external validity improved as the findings can be more generalizable to the target population.

A discussion of validity may also concern not only the survey instrument as a whole, but also parts of it in terms of a single item or scale. One example is summated scales that were used in the conducted survey. There are a few basic issues of the construction of a summated scale: conceptual definition, dimensionality, reliability and validity (Hair et al. 2006). The starting point for creating a summated scale is the conceptual definition that specifies the theoretical basis of the scale by defining the concept being represented in terms applicable to the research context. The content validity is the assessment of the correspondence of the variables to be included in a summated scale and its conceptual definition. Then the dimensionality is evaluated by controlling that the items are unidimensional i.e. are strongly associated with each other and represent a single concept. The factor analysis makes an empirical assessment of this by determining the number of factors and the loadings of each variable of the factors. In order to test unidimensionality, each summated scale should consist of items

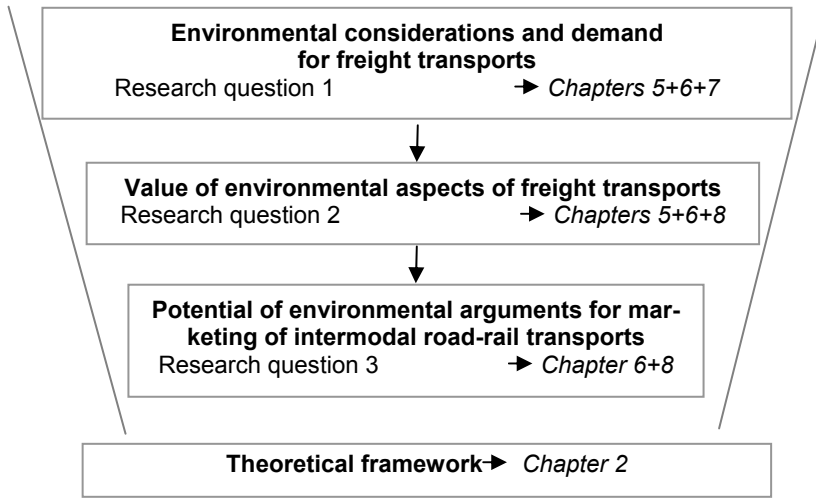


loading highly on a single factor in exploratory or confirmatory factor analysis. In this thesis, this was done through Confirmatory factor analyses. The summated scales extracted from the two factor analyses have been defined conceptually, were tested to be unidimensional and the reliability has been evaluated above. Finally, the summated scales may also be discussed in terms of scale validity i.e. the content validity. So, in the conducted survey the summated scales used were evaluated whether the full content of a concept's definition was included in each measure and it was judged satisfactory.

#### **4.5 Structure of results**

The research process with collection of data can be seen as a funnel, although it is not necessarily described in chronological order. The point of departure was the demand for freight transports, and in particular environmental considerations of these transports. The empirical data collected were then analyzed in order to see if there were any differences in results regarding different segments of transport buyers i.e. was the environmental aspect of transportation more important to some groups than others. The potential of environmental arguments along with modal choice were then applied to the case of intermodal road-rail transports. During the collection of empirical data, theory formed a base for knowledge.

The research process can be described in relation to the research questions and chapters, see Figure 4.4.



**Figure 4.4 Evolution of research process: research questions and empirical results chapters**

Part 1 of this thesis discussed and focused on; the background of the research problem, a theoretic model proposed after a literature review of relevant research areas, the research questions determined along with a discussion of the data collection methods applied. At this point, it is time to analyze the findings of the conducted studies. In Part II which is to follow, the results from the empirical data collection are presented in Chapters 5-8.

## PART 2: RESULTS

### **5 Environmental considerations in shippers' transport buying behavior -interview results**

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This chapter identifies important factors influencing environmental considerations when shippers make decisions about freight transports i.e. the way they are performed. These findings are based on explorative interviews conducted among four companies. The question the exploratory study tried to answer was “how (and why) do companies work with environmental considerations in connection to their freight transports”. The objective of this chapter is twofold. Firstly, there is a need for the description of environmental considerations in connection to the shipping companies' freight transports, and what role these have in the transport buying process. The results reported in this chapter contribute to this knowledge. Secondly, this chapter gives a better understanding of the research questions put forward in this thesis. The results helped in refining the research questions and also guided how they were tackled methodologically onwards, in terms of survey design and identifying relevant variables to include in the survey.

#### **5.1 Case descriptions**

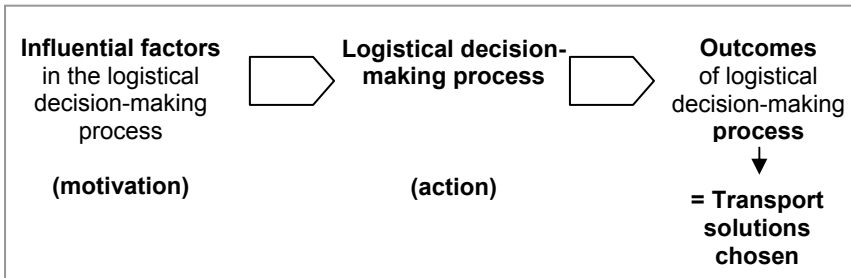
The selected company cases were briefly described above in Section 4.3. Three of them manufacture products based on forest materials and the fourth is a food retailer. They formed two groups with a business relation in each (see Figure 4.1). There is a high degree of dependency between the companies; Company 1 transported 1/3 of all goods to their largest customer Company 2, and Company 4 was the largest customer of Company 3 on the Swedish market. In order to visualize the contexts of these companies, it is useful to summarize their business and freight transports, see Table 5.1.

**Table 5.1 Overview of the freight flows of Companies 1 to 4**

	<b>Company 1</b>	<b>Company 2</b>	<b>Company 3</b>	<b>Company 4</b>
<b>Size</b>	Small	Medium	Large	Large
<b>Business unit</b>	Manufacturing plant	Manufacturing plant	Owns two manufacturing plants in Sweden	Major food retailer
<b>Products</b>	Industrial	Industrial	Industrial & consumer	Consumer
<b>Organization</b>	Part of industry group in Sweden	Part of industry group in Sweden	Division of MNC	Swedish retailer
<b>Freight volume</b>	135 000 tons	150 000 tons	Large	Large
<b>Exported volume</b>	65%	85%	80%	Yes, but mainly domestic
<b>External stocks/ /Distribution</b>		Stocks in Europe	A consolidation point in Southern Sweden	Approx. 6 domestic distribution centers
<b>Inbound transports</b>	All imported raw materials by boat	Domestic mainly by rail (also truck); by boat from Europe	Mainly by rail from Europe to consolidation, then trucks to plants	Mainly by ship from the world; mainly by train from Europe (& truck)
<b>Outbound transports</b>	>50% by boat worldwide, the rest by truck or rail	Domestic: truck; to Europe: by truck or inter-modal road/rail transport	To domestic retail customers by truck; to Europe by truck & rail	Between distribution centres by rail; to customers by truck
<b>Coordination of transports</b>	Part of domestic in-bound (with other companies) & at port (of in- & outbound)		Problematic since main markets (3 big cities) do not have return transports	Yes, so empty load transports were avoided

## 5.2 Structure of analysis

The decision-makers in this study, normally the Logistics Managers (henceforth referred to as LMs), are responsible for organizing and purchasing transports in each company. Their experience is the base that helps form opinions, make forecasts, execute transports and affect future transports (and their environmental impact). A schematic model of the shippers' decision-making process can be seen in Figure 5.1.



**Figure 5.1 Schematic model of shippers' logistical decision-making process**

The basic rational decision model aims at making optimal decisions on the basis of a careful evaluation of alternative courses of action (Fulop and Linstead 1999; Hatch 1997), but various weaknesses of the model have been put forward. A decision-making process is for example most likely to be influenced by non-rational, emotional and unconscious elements of human thinking and behavior, resulting in bounded rationality (Simon 1960). For example, the attitudes and opinions of the LMs regarding environmental effects, along with attributes associated with their personality, affect the outcome. There are probably additional factors influencing the environmental considerations in the logistical decision-making process than those put forward in this chapter (see full model in Figure 5.2 in Section 5.6), partly due to the limited number of interviews conducted. In addition, it has been argued by Brunsson (1982) that decisions should be put in the context of action, since organized action is the primary concern of managers rather than choice. Furthermore, action depends on more than a decision to act, namely also on motivation and commitment, and if it is effective or not depends on the implementation of decisions (Hatch 1997). Motivation and action have been inserted in the model in Figure 5.1. The presentation of the results from the interviews will follow this model.

### 5.3 Input: influential factors on environmental considerations

Influential factors identified in the interviews are: transport context, business aspects, internal and external environmental pressures. The last two mentioned can be regarded as parts of an institutional context, and are reported separately below despite several points of contact.

#### 5.3.1 *Transport context*

The *geographical* aspect, i.e. the location of the company, is significant regarding transports. The companies in Group 1 were situated in small villages but within a regional distance from major cities and a port. In Group 2, Company 3 had two production plants in Sweden about 150 kilometers from a large city and Company 4 transported in Sweden mainly between distribution centers but also to customers (local supermarkets). Another vital consideration in terms of geography is the location of the customers. Companies 1, 2 and 3 exported a large portion of their products, where as Company 4 mainly served the Swedish market, see Table 5.1. Especially the larger companies in Group 2 had major in-bound flows from abroad. The geographical premises are also linked to the issue of infrastructure, both regarding types available and their maintenance.

The *size of the company* and the *freight volume* are important, and often related, factors. A company with large volumes has a better negotiation position towards the transport providers, and volumes were significantly larger in Group 2 than in Group 1. A majority of the companies (Companies 2, 3 and 4) witnessed an increase in freight transports, partly due to increased volumes sold. Company 3 also experienced a trend of consolidation with fewer production plants in the world, which use better production techniques. On account of this, the LM believed in an increased importance of logistics in the future. In addition, Company 2 experienced a trend towards smaller shipments e.g. the average weight of shipments was 12.8 (metric) tons in 1999, compared to 3.8 tons in 2001.

#### 5.3.2 *Business aspects*

When companies choose transport solution and providers, *price and service factors* are essential. The LMs were asked what factors were considered to be most important, and those mentioned are presented in Table 5.2, in random order.

**Table 5.2 Important factors when transport providers are contracted**

<b>Important factors mentioned:</b>	<b>Company 1</b>	<b>Company 2</b>	<b>Company 3</b>	<b>Company 4</b>
On-time-deliveries	X	X	X	X
Price	X	X	X	X
Trust		X	X	X
Environmental aspects		X	X	X
Minimum of goods damage (incl. clean load carriers and right temperature)	X			X
Time frequency		X	X	
IT / Resources to follow-up transports		X	X	
Good invoicing routines		X	X	
Offer train solutions			X	
Easy to deal with	X			
Economic situation of transport provider		X		
Flexible cost (pay only for weight sent)			X	
Cost transparency (discount if large volumes)			X	
Good geographic coverage			X	
Can coordinate flows with other customers to reduce empty-loads			X	

X=The factor is mentioned by the logistics manager in Company Y (Companies 1-4 possible).

The transport providers sometimes played an important role in finding innovative transport solutions, which also affect the environmental effects of the transports, e.g. Company 3 only used one main transport supplier where collaboration was tight and trust vital. Company 4 also highlighted trust and new transport providers had difficulties entering the company transport system. It was stipulated how much cheaper a transport provider would have to be, compared with the ones used, to be considered. A long-term relationship was regarded as a way of reducing transportation costs, since the LM assessed the initial cost of building a basic relation to be very high. Previous experience from a transport provider was valued highly, which functioned as an entry barrier for new players, e.g. large European transport providers advancing into the Swedish transport market. This gave the four large transport providers on the Swedish market used presently by Company 4 a competitive advantage.

The largest companies (Companies 2, 3 and 4) asked the transport providers for environmental information regarding their transports. Common issues were e.g. environmental management systems, emissions, traffic safety, vehicles (motors, tires, etc) and oils used. Company 1 also got some information but it was the transport providers that emphasized it themselves. Company 4 was the company

that had formalized environmental demands to the highest extent when transports were bought and they informed transport providers about demands for the next time that transports contracts were to be negotiated (every two years). In this way, the transport providers were given a chance to make environmental adjustments.

### **5.3.3 Internal environmental pressures**

It is the *senior management* that is ultimately responsible and provides a platform for the environmental work within the companies. One task is to allocate resources, e.g. the CEO of Company 2 decided to implement ISO14001. All four companies had an environmental strategy, expressed in an environmental policy that also specified environmental goals. In one large company, the LM also belonged to the managerial group.

The environmental policies focused on different aspects. In Group 1, the environmental work had come into the business thinking early on partly due to regulation from authorities. The environmental strategy of Company 2 focused on emissions to water and air e.g. to reduce the water use and worked for a closed water system. The companies defined the environmental problems much in terms of negative effects to the local environment rather than in global terms (e.g. emissions of carbon dioxide). The companies had close ties to the local community, where they had been present for the last century. An important stakeholder group was the employees, often living nearby with their families.

There were different resources put into the *environmental function* and, consequently, also in the way that the environmental work was organized. In Group 1, the companies did not have any environmental departments. In Company 1, there was no one responsible for environmental work at the factory, apart from the CEO for the local site, but the business group had one. In Company 2, a person was in charge of the environmental work but he had other tasks as well. The companies in Group 2 had environmental departments consisting of several employees and headed by an Environmental Manager (henceforth referred to as EM), and one person was mainly responsible for the transports. In Company 3, for example, this person was in the process of developing a computation model for the logistics function in order to calculate the environmental effects of transports.

Various common *implemented systems* were used to communicate environmental work, which also affected the work of the logistics function. A channel of communication was through the annual financial reports and the corporate



environmental reports. All four companies included short information about the company's environmental work in the annual report for their business group but the three largest companies (Companies 2, 3 and 4) also issued a separate environmental report. In addition, Company 3 issued an environmental report for each production plant and also an internal report with follow-up objectives of each company division. The environmental policies were expressed in general terms such as "to minimize the environmental effects" or "to take environmental considerations into account in decision-making". Environmental goals were more precise. Common issues in the reports were the implementation of ISO14001, to communicate environmental information to stakeholders, to consider environmental effects when reinvesting, to educate employees, to reduce waste and emissions, and to exceed regulatory demands. Sometimes the transports were mentioned as a part of the environmental policy (e.g. Company 2). Company 3 planned to extend the environmental report into a sustainability report<sup>27</sup>, which they did later on.

The separate annual reporting to local authorities from Companies 1, 2 and 3 contained data e.g. about emissions in order to obtain permits. In Company 3, these data were also used in the LCA (life cycle assessment) calculations<sup>28</sup> that in turn were used in the emissions calculation tool for transports mentioned before. In one product group, the company had chosen to use LCA as a communication tool instead of eco-labeling, since the LCA showed that the "normal" product had a better environmental performance than the test product for eco-labeling (which was rejected by customers). Results from focus groups with consumers in one product category had shown that environmental aspects were regarded as important.

The eco-labeling programs prove that an independent body of certification has approved the product. For Companies 1-3 in the forest industry, environmental-labeling has played an important role e.g. FSC<sup>29</sup>-labeled forest or the "Paper profile"<sup>30</sup> environmental product declarations (Paper Profile 2004). Company 2

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<sup>27</sup> An integrated Triple Bottom Line reporting gives equal weight to social, economic and natural bottom lines (KPMG/Wimm 1999). Guidelines from Global Reporting Initiative (GRI 2004) are often used.

<sup>28</sup> LCAs are used to calculate a product's environmental effects from extraction to disposal; a cradle-to-grave approach in stages: (1) Inventory (2) Impact analysis, (3) Impact assessment (4) Improvement (Welford 1999).

<sup>29</sup> The Forest Stewardship Council is an independent NGO that provides standard accreditation for companies to promote sustainable management of forests (FSC 2004).

<sup>30</sup> See also [www.paperprofile.com](http://www.paperprofile.com) for more information.

worked with the Nordic eco-label certification “the Swan”<sup>31</sup> (SIS 2004) and had e.g. put demands on Company 1 to alter the chemical content of the pulp delivered in order to meet the Swan criteria. Company 3 had also chosen to work with this label on their products, since it was considered to have a high credibility and was well-known to the Swedish public. The EM in Company 2 recognized the benefits of eco-labeling for pushing the development forward, but he feared that it could also restrict it. The selection of pulp became more limited when it was bought this way by creating demands. The EM commented this:

*“The implementation of environmental certifications will allow us to put demands on the suppliers. There are high hopes that this will not knock out our suppliers but instead they will be able to join in. The ISO system is designed so that suppliers are forced in, and when we join in we must affect our suppliers. But we can’t affect them if we can’t make business with them. Then they, especially suppliers in Eastern Europe, will not have money nor will they accomplish what we want them to.”* (EM Company 2)

The Environmental Management Systems (EMS) are documented ways of working and having routines for control of a company’s environmental management, and are issued for a local site of a company, e.g. a plant. Demands are made on a corporate level, such as environmental policies and goals, but they affect specific functions, e.g. tasks for the purchasing unit to lay claims on environmental performance of products and services. All activities are targeted towards constant improvement of the environmental work. All respondents highlighted the importance of certification, although not all had carried it through. The larger companies in Group 2 implemented it, but not the smaller ones in Group 1. It was ISO14001<sup>32</sup> that the companies planned to implement, or had implemented. Only Company 3 implemented EMAS<sup>33</sup> as well. The implementation of an EMS was led by one person in Company 2 and in Company 1, and there were apprehensions for the additional work load that the future implementation would bring. The fact that a certification was being implemented was normally well-known throughout a company, but persons working in areas other than the environmental function did not always have a clear picture of what it really meant e.g. consequences for the logistics department in Companies 1 and 2. This information was probably going to be distributed after the certification was done, but in this way there was a risk that the underlying ideas were not spread outside the environmental function.

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<sup>31</sup> See also [www.svanen.nu/Eng/about/](http://www.svanen.nu/Eng/about/) for more information about the Swan.

<sup>32</sup> The International Organisation for Standardisation, a network of standards institutes of 148 countries (ISO 2007).

<sup>33</sup> the Eco Management and Audit Scheme, the standard of the European Union (European Commission 2007)

### 5.3.4 External environmental pressures

One source of pressure is legislation, carried out by *authorities*. The forest industry is heavily regulated in terms of environmental laws and restrictions on emissions and effluents from plants. Companies 1, 2 and 3 prepared reports every year providing data required by the local authorities, and investments that decrease the negative environmental effects had been made.

Company 2 had been forced to take measures to reduce the environmental effects of their production since the mid 1960's on the account of legislative pressure, mainly due to the sensible maritime environment surrounding the plant.

*"In 1964, there was a warning sign with a skull on it by the water, keeping people from swimming. We stopped the production of sulfite pulp in 1966 and, as the first paper mill, planned to produce an environmentally friendly paper. To think about the environment around us. Today, I would say we are the world's most environmentally friendly paper mill. This has become a niche for us in terms of sales."* (LM Company 2)

According to Company 2, the company had turned the environment into a competitive advantage and the environmental profile was further emphasized by the company's economic contributions to three regional projects: a national park, a marine research institute and a wildlife sanctuary for endangered animal species.

The EM in Company 3 described the development of environmentalism in the company like this: permits of emissions to air and water were in focus in the 1970's, "green" products came in the 1980's, the financial market went green in the 1990's (e.g. environmental reports). First, the factory was in focus, and then the product and later focus shifted towards the company. When professional customers started to ask us for environmental information, this led to environmental management systems, environmental evaluations and product declarations.

*"Then the whole company is involved in a whole different way. But the authorities have been rested and have not had so much to do and are rather bored, so now they are coming back. More laws and regulations are coming from the European Union, so now it is more regulated again by the authorities. Thus, things will happen."* (EM Company 3)

There are also environmental demands from *customers*, especially from those who have implemented an EMS. The LM in Company 2 had been asking for environmental information since the mid 1990's, even without being ISO14001-

certified. He felt that he had not been able to be tough on these “demands” without having a certification, but he felt strengthened by the thought of getting one in the near future. Even so, Company 1 thought that their largest customer had been certified for a long time, and felt pressured to do the same thing. In this way, Company 2 affected the environmentalism in Company 1 backwards in the supply chain. Naturally, the demands from end-customers were strongest in Group 2, since they dealt with consumer products. Often, there was a trade-off between price and improved environmental performance.

*“The company must have profitability. The customers are not opponents but you don’t make environmental improvements that are 10% better than the customers’ demand, because then you will have to raise price. And then you lose the customers anyway. There is a delicate balance to be struck all the time.”*  
(LM Company 4)

There are also environmental demands from **suppliers**, of products and of transport services. As discussed before, trust was an important factor when companies sign contracts with transport providers. A form of trust was manifested when the LM in Company 2 assumed that the transport provider was guided continuously by environmental considerations of the transports supplied to customers.

The LM in Company 2 received an invoice of SEK 5000<sup>34</sup> from a major transport provider when he had asked for environmental information. The transport provider had experienced an increase of customers demanding this type of information, which in turn forced the company to employ more people. Nevertheless, this annoyed the LM, especially since none of the other transport providers had charged the customers for this service. The LM informed the logistics provider that this fact was contributing to their minus side when selecting transport providers. The invoice was then withdrawn “since you are a large enough customer to get it for free”, as the company sales representative put it. To conclude, the transport provider wanted to charge small customers the additional cost for a service related to environmental work. However, it is reasonable to assume that smaller companies have smaller resources devoted to environmental work and this practice further impede environmentalism in small companies.

Environmental pressure also arises from various **NGOs**. The EM in Company 3 participated in the working group of the Swedish standardization committee and had good insight into the status of certification in the business in Sweden but

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<sup>34</sup> Equivalent to approx. USD 730 or EUR 545, on March 11 2005 (Forex 2005).

also internationally. The EM was also active in the Swedish NTM, in which organizations, companies and researchers work together e.g. for a common calculation method of environmental effects of transports and standard evaluation forms for environmental assessment of transport providers. Company 3 was going to use modified data from NTM instead of inventing a new system, which probably was going to save both time and money. The EM worked together with people involved in NTM in a previous project, where a few large companies exchanged knowledge based on experiences in environmental work. The informal network of people established through joint projects and NTM was considered to be an advantage and a complement to collaboration within the company group.

## 5.4 The process: key issues influencing environmental considerations

Four critical key issues that strongly affect the environmental considerations of the logistical decision process will be discussed below.

### 5.4.1 *Trade-offs of price, service and environmental aspects*

All companies in this study mentioned on-time deliveries and price, and three of them mentioned trust and environmental aspects as being important when choosing among transport solutions and transport providers. **Price** was the first aspect that came to mind for some LMs when they were asked about the most important criteria when purchasing freight transports. Company 1 emphasized price since their product is a non-refined one early in the product chain and has a low-selling price. After discussing the issue more in detail with the LMs, it was found that the situation was more complex than it appeared to be. Price was important but not by far as important as certain other aspects (e.g. delivery time, services and environmental aspects). These are required before price can be used as a principal selection criterion and one example already mentioned was trust as a basic requirement before a transport provider was eligible (e.g. Company 4).

**Time** was highly required in the purchasing process and has been regarded as a factor of increasing importance for the last few years e.g. by Companies 1 and 2. Company 2's customers could order until noon and get the goods the next day, including northern Europe and the Benelux countries.

*“As a small actor in comparison with the large X [name of main competitor] we have to stick our neck out so we say we are ‘large enough to be efficient, small enough to be flexible’. This means that we can take orders, find transport systems and re-book orders very quickly, for example if a large booking comes in. It has been our motto for years.”* (LM Company 2)

On-time delivery was the single most important criterion for Company 4. The company tried to get control over all their inbound and outbound transports and aimed at buying all goods ex-works. The company worked with time windows of 30 minutes and if the transport providers did not manage to deliver within the scheduled time window, they had to pay fines and wait for the next available time window.

The importance of **environmental aspects** when selecting transport provider was discussed in the interviews. It was difficult for the LMs to quantify “how much” environmental considerations were taken into account; rather they were included as qualitative parameters along with other ones. Interestingly, the companies in Group 2 both stated that they were prepared to pay a little more for train transports, since these were considered an environmentally better alternative than truck. Company 3 had problems finding train solutions since they often cost 30-50% more than truck. However, the LM estimated that it could be an alternative, but only if the price would be 5% higher as a maximum.

*“We are prepared to pay a little more, but cannot accept an alternative that is less efficient and at the same time more expensive than the one we have today.”* (LM Company 3)

A similar approach had been used by Company 4. A certain price was paid for a specific transport relation but a few percent more on the price was acceptable if train was chosen. These figures were considered to be company secrets.

*“A few percent may seem little, but on a transport relation priced at 20 million kronor<sup>35</sup>, it makes a difference. However, on a small relation it is not much.”* (LM Company 4)

#### **5.4.2 Choice of transport mode**

The majority of respondents believed that choosing train solutions or intermodal transports was important in order to improve the environmental performance of

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<sup>35</sup> Equivalent to approx. USD 2.9 million or EUR 2.2 million on Mar 11 2005 (Forex 2005)

their transports and that train was an environmentally better alternative than truck. Three of the companies strived for increasing the share of train transports whenever possible, in some cases formulated in the company environmental policy, and one company wanted to at least keep the same share. Another advantage for Company 1 was for production reasons, since having a train wagon at the plant resulted in longer time for loading than if a truck would have been used, which would result in more stress through unnecessary waiting time and an increased risk of mistakes.

The LM in Company 2, however, expressed doubts about the “environmental-friendliness” of rail due to the fact that old diesel engines were used when collecting goods in the factory, before connecting to the State-financed railroad network. The maintenance of the Swedish rails connected with private industry is no longer a responsibility of the State, but normally of the companies. A further barrier for using trains faced by Company 3 was that the industry rails of one of their factories were covered with asphalt in the 1970’s, when the railway was not considered to be a cost-efficient way of transporting. The company is now trying to recover the tracks on the sections where they have not been removed. The LM believed it to be hard to go back to using rail once the share as a mode of transport was cut back. He contrasted Sweden with some countries in Europe where the company operates e.g. Austria. There the share has been more stable historically – the rail companies are very competent and the customers there are used to rail. Therefore, Company 3 uses rail in these markets to a large extent, even in shipping directly to customers, which is not the case in Sweden where rail is only used between distribution centers. Rail was used on international freight transports e.g. more than half of the incoming European freight arrived on train.

The forwarding agents used combined transports to a limited extent within Sweden, and the LMs in Companies 2 and 3 stated that they are never offered combined transports. This decision was made by the forwarding agent, rather than by the LM. The larger companies in Group 2 told the forwarding agents that they were positive towards combined transports if the price is right and if deliveries are on time. The companies in Group 1 used combined road-rail transports to some extent, mainly for exports. Company 1 put 40% of outbound transports on truck, but about 1/3 of these were later re-loaded to detachable load-carriers on rail to Europe. Also, Company 2 had a high usage of combined road-rail transports to/from Switzerland and Austria, and shipped all freight to Italy in this way. This was, to a large extent, proposed by the transport providers. The reason was not mainly due to the restrictions on truck transports through the Alps, but rather that the LM commended the railway administrations in these countries for their competence.

*“They are very progressive. They have built up systems for example in Italy, so if I have to send a lot of goods to Milan then there are train systems. There are variations. In Sweden there are no systems whatsoever.” (LM Company 2)*

Company 1 found that in times of strikes at the Italian border, the combined train transports are given priority. Also, their customers in Italy were more used to strikes and the company seldom received complaints concerning delivery delays, probably because they delivered with a comfortable margin. If a load-carrier broke down, this implied a delay of 1-2 days but the customers had learned to keep buffer stocks. In other words, the customers calculated imperfections in the transport system.

### **5.4.3 Cooperation and conflicts between functions**

The large companies in Group 2 had environmental departments and the success of their work depended to a large extent on the collaboration with other departments. In the case of transports, co-operation with the logistics department was of course very important and one example was the tool under development in Company 3 to assess different transport solutions with regards to their environmental impact, but this collaboration has not been evaluated yet. Another risk is a form of decoupling of the environmental work and the rest of the organization, which is manifested in that persons in the organization think that “environmental work is not my table. We have a person responsible for that”. Is this a real risk?

*“It is really, really dangerous. These persons do exist. We are trying harder and harder to go beyond that; we MUST involve all the divisions in the company. We try to do this as much as possible”.* (EM Company 3)

In Company 3, there had been environmental working groups at the business site with persons mainly from production, logistics and purchasing. The EM believed that there had been a back-lash for environmental aspects, since it was assumed that companies worked with them but not many asked for this kind of information and rather considered it a basic requirement. This in turn led to people losing interest in the matter within the company and the environmental work was then placed as a lower priority:

*“Everyone wants us to be here, we are supposed to have an extremely high level of knowledge, to be able to answer questions from customers before they even have asked them; but we are not supposed to be seen or noticed. That is a short summary.”* (EM Company 3)



Due to this, there was a lively discussion within the company group in order to decide upon what priority the environmental work should have and on what level. One example was a large on-going project where people in management from different divisions participated and reported to the Steering council of environmental work in the business group. The president of the council was also a member of the senior management group. There were conflicts between different functions in Company 4 as well. The LM perceived the people at the environmental function as real enthusiasts and not very realistic concerning business economics. Still, he admits that it does give positive results in the company.

*“The environmental people are almost fanatic as they are always going on about the environment, no matter what the issue. They push their message through and if 50, 20 or 10% sticks, I have to admit that it does increase the environmental consciousness in the company.”* (LM Company 4)

He mentioned as an example that introducing the sorting of waste in their stores was no problem. The LM also told an anecdote that illustrates that environmental aspects are perceived as strongly charged morally and are tightly linked to the persons working with them. He reacted strongly when a member of the environmental department bought a new, private gasoline-driven car. When he asked why the person had not bought a car using an alternative fuel, he got the answer that it was too expensive.

*“I told him that he claims to care about the environment, but it was obviously another story when it came to his own private economy. At the same time, he wanted the company to buy such vehicles, no matter the cost.”* (LM Company 4)

It can be concluded that there were examples in the companies of persons that complained about the lack of understanding from people in other functions or senior management. This was not only due to the persons working with the issues, but also to the apparent clash of economic and environmental goals.

#### **5.4.4 Costs of environmental considerations**

There were examples in the companies where environmental improvements did pay off, also economically. One of them was a waste management program that was introduced in Company 2 a few years earlier, where the waste was sorted into 33 different categories of rest materials. A recycling company came to collect and the company was paid for most materials, except for waste oil which they had to pay for instead plus transportation costs. At the end of each month,

the total amount ended up as a cost or a surplus. It took about three years to actually make money on the system. In a case like this, it is easy to justify the additional work for environmental improvement. However, there had been cases of environment benefits but at an additional cost, and there had been discussions about who would have to pay the cost.

*“Environmental work is discussed internally in the company and everybody has different opinions of it. One side yells that it should not cost anything while the other side yells that we have to have a profile as an environmentally conscious company. And we have to meet at some point.” (LM Company 4)*

If the conflicts could not be solved between different departments, then the senior management of Company 4 had to make decisions at the strategic level. This also contributed to the creation of policies. One example was the before mentioned policy about how much more the logistics department could pay if the freight were sent by rail instead of truck. The LM had required a decision as to how much extra the company would pay and on which budget, since he thought that “everyone wants us to take environmental considerations but who will pay the additional cost?” The EM in Company 3 recognized that, although a company cannot be operated unless the economy was in order, there were frequent conflicts between economic and environmental considerations, and the environmental side was sacrificed e.g. when an investment was considered. On the other hand, the LM in Company 3 pointed out that when a more efficient logistics solution was introduced for economic reasons, it also resulted in reduced environmental effects e.g. a higher use of return transports.

## **5.5 Outcomes: transport solutions chosen**

The outcomes of the logistical decision-process are the implemented transport solutions and the focus is on the transport providers chosen and the environmental impact. The modes of transport used were shown in Table 5.1.

### **5.5.1 Transport providers**

All LMs asked transport providers for offers for each transport relation geographically, except for Company 3 that used only a main transport provider. Also, the contract was more important in the larger companies. Company 4 had contract negotiations for transports every two years and Company 3 had a contract with the main transport provider valid for 18 months (but it was prolonged automatically if Company 3 did not have any objections). Company 4 invited

offers for about 90 transport relations. In Group 1, minor agreements, equal to offers, were used instead of general contracts. E.g. Company 1 had one local truck transport provider since transports were often needed on short notice for deliveries on the spot market. In addition, the larger transport providers were not competitive on price for full truck loads, which the LM believed was because they specialized in less-than-a-truckload shipments. The only basic contracts used were with rail companies negotiated by the company group and valid for two years. The sea transports were most heavily regulated by formal contracts. Company 2 used about 110 similar agreements as Company 1, but four of the providers had been selected for being main suppliers of transport services. These were not large transport providing companies but smaller ones, and they did not offer the lowest price. The reason was instead Company 2's commitment to customers to be able to book orders at short notice.

### **5.5.2 Environmental impact**

When analyzing the environmental considerations for the transport decisions, it is useful to study what the LMs considered to be transports that are better for the environment. The most common mode of transport in all companies was truck. The choice of transport mode was important, since all companies considered rail to be better for the environment than truck. A majority of the LMs interviewed (Companies 2, 3 and 4) also believed in transports combining different modes of transports, i.e. intermodal transports, as a viable solution for the future under the condition that requirements such as time of delivery and flexibility can be guaranteed. Nevertheless, the transport mode was not the only environmental aspect of transportation taken into consideration, as pointed out by two LMs.

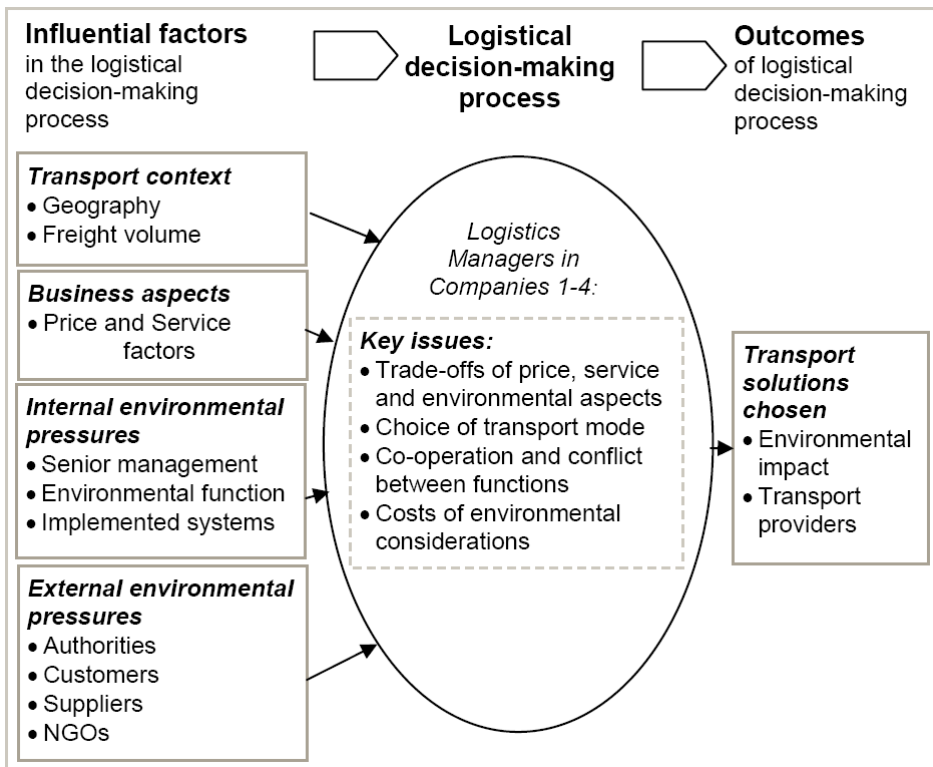
*“It is rather a matter of building transport systems as efficiently as possible. This may include looking at the size of shipments, to coordinate companies in a certain region that have deliveries the same days and to transport less kilometers than we would have done if the customers were to decide on the basis of their own requirements and perspectives.” (LM Company 3)*

What about other environmental effects? First, the direct negative environmental effects such as air pollution and accidents could be reduced by using better oils, tires and engines with higher environmental standards, etc. and these issues were included in the environmental evaluation of transport suppliers that had been carried out in Companies 2, 3 and 4. Regarding the indirect environmental effects, mainly the emissions of carbon dioxides, all the LMs were well aware of the problem. The companies tried to work with fewer transports, higher load factors and/or use of return transports e.g. Company 2 coordinated

inbound and outbound flows at the port. The general impression of the environmental considerations regarding transports in the companies was that the tools and methods for doing this was very much in a development phase, e.g. environmental evaluation forms of transport providers. The need had been identified but the routines were not in operation yet.

## 5.6 Proposed model

The findings in this study can be summarized in the proposed model in Figure 5.2, which is an extension of the original model (see Figure 5.1).



**Figure 5.2 Proposed model of environmental considerations in the logistical decision-making process**

The findings will be further discussed in Section 5.7 and in the conclusions in Chapter 9.

## 5.7 Discussion

The companies are well aware of the environmental problems of freight transports and some of them try to work proactively in order to keep ahead of legislation, especially the larger ones in the study. Historically, the authorities have been a strong driving force for the environmental work especially in the production companies in Group 1, but claim that it had become a competitive advantage (Company 2). The EM in Company 3 described the evolution of environmentalism in the company from the 1970's with the regulatory authorities setting the agenda, for "greener" products and environmental management. This description coincides with the last three of four stages identified by Hoffman (2000): industrial environmentalism (1960-1970), regulatory environmentalism (1971-1981), environmentalism as a social responsibility (1982-88) and strategic environmentalism (1989-1999). In this view, the first stage focused on specific issues of visible forms of pollution (such as DDT), but corporate environmentalism developed over time and in the fourth phase, industry took a more proactive stance. However, the EM in Company 3 believed that the strong role of the authorities was coming back.

The companies also co-operate externally with regard to environmental impact of logistics practices. One NGO was the Swedish NTM (2005) that probably has contributed to knowledge in environmental effects of transports among the transport buyers. For example, one company in the study (Company 3) was going to use modified data from NTM instead of re-inventing an own database. This benefits the companies and, naturally, the environment.

Lippman (1999) discusses supply chain environmental management and identifies four characteristics (1) Top-level leadership, (2) cross-functional integration, (3) effective communication within companies and with suppliers, (4) effective processes for targeting, evaluating, selecting and working with suppliers. Such management can also be turned into a competitive advantage if used in an efficient way. Results for reducing environmental effects can be more efficient if environmental management is integrated in the whole supply chain and not only in an individual company. In this study, one useful practice directly linked to this is the evaluation of transport suppliers' environmental performance. This creates an opportunity if the companies in each business relation decide to further integrate the collaboration on environmental matters as far as transports are concerned. Certifications in the environmental area, EMS or eco-labeling schemes, were becoming more common and recognized as a way of giving credibility to companies when they e.g. put demands on suppliers (as in case of Company 2).

The LMs interviewed had key roles as decision-makers of transport solutions and exerted an influence on environmental effects of the transports performed, which is in accordance with results of Wu and Dunn (1995) who concluded that the LMs' decisions have a direct impact on the environment. Many of the companies studied stated in their environmental policy that train transports should increase and at the same time, the LM was normally the operative decision-maker. The process of taking environmental considerations into account when choosing transport solutions is complex. Companies asked for environmental information (Companies 2, 3 and 4) from their transport suppliers, but had not yet worked out routines or decided clearly what weight the environmental considerations should have in the purchasing process. It was also the LM that confronted the *trade-offs between price, service qualities and environmental aspects* of the transport solutions, which resulted in a final decision of which alternatives to choose based on mainly qualitative judgments of the LM. The *choice of transport mode* is included as an important parameter in this process.

The companies in this study had different focuses regarding their environmental work. Some of them primarily encountered local environmental problems, often in the form of visible pollution, especially Companies 1 and 2 that focused on emissions to air and water. The environmental reports differed but the environmental policy was normally expressed in broad terms e.g., "to minimize environmental effects". Roy and Vézina (2001) claimed that "environmental management has gone from an add-on function to an integral part of business operations, as it is often viewed as central to a corporate mission and therefore integrated into all levels of strategies". Although the companies studied had persons in the environmental function, an EM (in Company 3) did not believe that environmental considerations were an integrated part of business at that point. Rather there were discussions about how to combine economic and environmental goals, and what environmental costs would be acceptable. The work with environmental considerations is sometimes done in *co-operation* with persons at the environmental function, but there are sometimes *conflict between functions* regarding costs. If the conflicts prevail, the senior management has to make decisions and in that way policies are made for future work (Company 4).

Making environmental improvements may entail an initial investment in time and money, but it will pay off later (e.g. the introduction of a waste management program in Company 2). However, it is probably more common that an additional amount of work is required (e.g. to introduce an ISO14001 certification), and/or that additional costs are induced. These costs can occur within a company (e.g. Company 4 had accepted a higher cost for using trains), or between companies in the supply chain (e.g. the transport provider that charged a fee for answering environmental evaluation forms from smaller customers). If

environmental considerations are going to be an integrated part of the business processes and shared among functions in a company or between partners in a supply chain, then these costs must inevitably be on the agenda in the budget or negotiation discussions, along with e.g. quantities and prices of products. These *costs of environmental considerations* cannot be ignored; otherwise it will create conflicts.

The amount of transports had increased in all companies and a majority of the LMs (in Companies 2, 3 and 4) were interested in finding new transport solutions and, also, they believed in transports combining different modes of transports, i.e. intermodal transports, as a viable solution in the future if their requirements e.g. time of delivery could be met. At the same time, environmental considerations are taken into account when transports are bought to a greater extent. The question is whether the environmental aspects of how the products are transported can be viewed as an added value to the transport buyer.

It was concluded that the findings of this study needed to be measured and tested on a larger scale among shippers. The best option seemed to be to use a survey method and to include environmental considerations regarding freight transport purchasing in the questionnaire. A large survey study covering a whole range of aspects of shippers' freight transports was elaborated and conducted together with two other members in the research program of intermodal road-rail transports<sup>36</sup>. The results of this survey study relevant for the purpose of this thesis are presented in the following Chapters 6, 7 and 8.

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<sup>36</sup> Bernt Saxin and Jonas Flodén





## 6 The basis for freight transport demand - survey results

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A valid market analysis is a pre-requisite in market management. Before analyzing potentials for marketing of intermodal road-rail transports using environmental arguments, more information of the freight transport market in Sweden is needed. One purpose of the conducted survey was to collect some of this information in order to facilitate an analysis of the market for intermodal road-rail transports. The aim of this chapter is to provide the results from this collected, necessary data that will focus on:

- The freight flows; in terms of volume, distance, geographical pattern and transport modes used.
- The relations with the transport providers the companies have; in terms of number and length of contracts.
- The top priorities when companies select transport provider.
- The trade-offs with environmental aspects when companies select transport solution.

The results from the conducted survey in this chapter<sup>37</sup> are presented in sections that reflect the same content as in these four points. These results may help in identifying the opportunities, as well as the barriers, for the marketing of intermodal road-rail transports – regardless of whether environmental marketing arguments are used or not. Another vital purpose of these results is to put the environmental considerations of freight transport in relation to other important aspects that shippers take into account when purchasing freight transports.

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<sup>37</sup> Parts of the results in this chapter were elaborated jointly with Bernt Saxin and Jonas Flodén, and were also reported in a paper (Saxin et al. 2005)

Note that the response rate on individual questions presented may vary slightly from the general response rate. A confidence interval of 95% will be used in all results, unless stated otherwise. All averages for the total population are stratified averages according to the weight of each stratum to the size of the total population in the target group.

## 6.1 Freight flows

The most obvious way to get an overview of the existing freight transport flows is by starting with existing statistics. The latest national commodity flow survey, collected as part of the official Swedish statistics, was carried out in 2004/2005 and included mainly manufacturing, mining and wholesale sectors (SIKA 2006a). This extensive survey was done among shippers and provided information about the type of commodities shipped, their value, weight, and mode of transportation as well as the origin and destination of shipments. The data showed that the total volumes from the Swedish manufacturing and wholesale industry were estimated at 149.8 million tons<sup>38</sup>. It did not include information about determinants for the transport decision e.g. service quality dimensions, costs and environmental impact. Also, larger academic studies on a national level with this information about the freight transport market have been lacking. The carriers have statistics about their own customers but these are not made public. The conducted survey aimed at providing both the flow data statistics and the underlying factors for the shippers' transport decisions that lead to the transport flows. The flow data are the basis but it needs to be broken down into a set of useful variables; the freight volumes transported, the length of transports, the destination of transports and the modes of transport used.

### 6.1.1 Freight volumes transported

A basic yet important task was to map the outbound freight volumes from the companies. Approximately 70% of the respondents answered in metric tons and the remaining used other more volume-related measurements, e.g. cubic meters, pallets, number of parcels or shipments, TEU's. These latter volumes have been re-calculated in Table 6.1 to metric ton equivalents<sup>39</sup>. (see survey question 1 in Appendix 3)

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<sup>38</sup> Of which manufacturing = 106,074 million tons, and Wholesale = 43,685 million tons.

<sup>39</sup> The volume multiplied by an actual or estimated weight equivalent factor, usually density of the freight according to direct information from the respondents.

**Table 6.1 Survey data of total and average weight shipped; estimations of number of local units, total weight (in thousand ton equivalents) and proportions (%)**

Stratum	Survey data			Estimations from survey data		
	n	Weight of volume	Mean	Local units in Sweden	Total weight in Sweden	% of total volume
Small manufacturing	53	403	7.6	2,244	17,080	14
Small wholesale	42	100	2.4	3,385	8,041	7
Medium manufacturing	173	6,239	36.1	787	28,389	24
Medium wholesale	50	398	8.0	1,063	8,462	7
Large manufacturing	126	25,267	200.5	222	44,517	37
Large wholesale	86	8,430	98.0	131	12,842	11
<i>Total all strata</i>	<i>530</i>	<i>40,838</i>	<i>15.2</i>	<i>7,832</i>	<i>119,332</i>	<i>100</i>

Table 6.1 shows the freight volumes sent by the participating companies in the survey sample; in total 40.8 million ton equivalent weight. However, what is even more interesting is using these figures for the calculation of estimated freight weights transported in Sweden, by using the stratum means and the number of business units in Sweden in our target population calculated in Table 4.3. The estimated total freight sent in Sweden is then approximately 119 million ton equivalents. It is obvious when looking at the shares of this estimated volume that the manufacturing companies account for the major part, 75% (14%+24%+37%). The share is around the same, 72%, if the volumes from companies with more than 100 employees are added together (24%+37%+11%).

This indicates that our calculated total freight estimation based on the conducted survey would represent about 80% of the total freight volume shipped in the commodity flow survey of 149.8 million tons. Note however that this includes all companies, whereas the conducted survey only included companies with outbound transports exceeding 150 kilometers. As pointed out earlier, the main reason for choosing this target population for the conducted survey was to target the potential freight for intermodal road-rail transports.

### **6.1.2 Destination of transports**

In order to map where the freight flows are directed, the respondents were asked to divide their freight volumes among destinations (see survey question 11 in Appendix 3). The results are displayed in Table 6.2 and in Table 6.3 and show,

not surprisingly, that more than half of the freight is sent within Sweden (57% in average). It also shows that most exports are conducted by manufacturing companies, particularly for more distant destinations. Interesting to note is that a very small share of the large and medium wholesale companies' freight are exported and most of the freight is thus shipped domestically (over 80% for wholesale companies regardless size). However, these companies only ship 10.2% (i.e. 2.5%+3.2%+4.5) of the total freight exported.

**Table 6.2 Proportions of outbound volumes divided on domestic and exported freight (%)**

Stratum	Total domestic freight	Proportion of total freight per stratum		Proportion of total freight	
		Domestic %	Exported %	Domestic %	Exported %
Small manufacturing	12,566	73.6	26.4	18.5	8.8
Small wholesale	6,768	84.2	15.8	10.0	2.5
Medium manufacturing	14,713	51.8	48.2	21.6	26.6
Medium wholesale	6,823	80.6	19.4	10.0	3.2
Large manufacturing	16,564	37.2	62.8	24.4	54.4
Large wholesale	10,535	82.0	18.0	15.5	4.5
<i>Total (n=536)</i>	<i>67,970</i>	<i>57.0</i>	<i>43.0</i>	<i>100.0</i>	<i>100.0</i>

Table 6.2 shows that the large domestic freight volumes are generated by manufacturing companies and also by large wholesale companies. The small manufacturing companies have a substantial share of these flows (about 12,500 thousand tons which is 18.5% of all domestic freight) i.e. somewhere between the medium manufacturing companies (21.6%) and large wholesale companies (15.5%). The large manufacturing companies ship only a bit over 1/3 of their freight within Sweden (37.2%). The destinations are seen in Table 6.3.

**Table 6.3 Proportions of outbound freight volumes divided among destinations (in thousand ton equivalents and totals also in %).**

Stratum	All	Estimated total for destinations:					
		Sweden	Norway	Denmark	Finland	Rest of Europe	Rest of World
Small manufacturing	17,080	12,566	804	449	216	2,136	908
Small wholesale	8,041	6,768	257	135	96	536	248
Medium manufacturing	28,389	14,713	1,174	1,489	1,100	7,127	2,786
Medium wholesale	8,462	6,823	429	280	245	532	152
Large manufacturing	44,517	16,564	1,701	1,471	1,271	15,418	8,092
Large wholesale	12,842	10,535	425	387	281	716	499
<i>Estimated Total in Sweden</i>	<i>119,332</i>	<i>67,970</i>	<i>4,792</i>	<i>4,211</i>	<i>3,209</i>	<i>26,466</i>	<i>12,686</i>
Proportion of total, % (n=536)	100.0	57.0	4.0	3.5	2.7	22.2	10.6

About 10% of all the freight is shipped to our neighbouring countries Norway, Denmark and Finland where Norway has the largest share with 4% of the freight. The rest of Europe represents 22% of all freight sent which is a substantial amount and the large and the medium manufacturing companies are dominating with 85% of all freight ( $(15,418+7,127)/26,466$ ). These transports have a distance that would fit intermodal road-rail transports well. The rest of the world has a share of 10.6%, and assumingly these transports generated by manufacturing companies are largely shipped by boat. However, an intermodal road-rail solution to a port is possible for these freight flows. Note that certain infrastructure at the shippers is required, e.g. a loading ramp at the shippers.

### **6.1.3 Length of domestic transports**

It is not only the freight volumes that are of interest, but also the length of the freight flows. Intermodal freight transports are best fitted for longer distances since the costs of terminal handling must be compensated by the lower distance-dependent unit cost of railway in haulage in comparison with road haulage. The limit where an intermodal transport could compete with a direct road transport used to be set at about 500 km earlier, but today it is probably around 300 km and distances as low as 150-200 km are discussed in the European Union (Godstransportdelegationen 2002). Therefore the survey asked the respondents to state the share of the freight volumes sent to domestic locations in four categories of distances: 0-150 kilometers, 150-300 kilometers, 300-600 kilometers and more than 600 kilometers (see survey question 12 in Appendix 3).. These

shares can be used in combination with the total freight volumes sent domestically calculated before (see Table 6.3) and the results are shown in Table 6.4.

**Table 6.4 Estimated average and total goods sent within Sweden divided on transport distances (in thousand ton equivalents and totals also in %).**

Stratum	Estimated total for distance categories					Total >300 kms %
	0-150 km	150- 300km	300-600 km	600- km	All	
Small manufacturing	4,506	3,930	2,602	1,528	12,566	33
Small wholesale	2,242	2,115	1,603	808	6,768	36
Medium manufacturing	3,759	4,409	4,336	2,209	14,713	44
Medium wholesale	2,160	1,867	2,235	561	6,823	41
Large manufacturing	4,073	4,067	5,524	2,899	16,564	51
Large wholesale	4,205	3,269	2,141	919	10,535	29
<i>Estimated Total</i>	<i>20,947</i>	<i>19,657</i>	<i>18,442</i>	<i>8,923</i>	<i>67,970</i>	
Category average, % (n=457)	32,8	28,9	27,1	13,1	100,0	40,3

When discussing the total volumes on different distances, it is important to remember that the figures represent the relationships among our target population i.e. companies having freight transports exceeding 150 km. The distance 0-150 km has in reality larger freight volumes than the shares presented in this survey, as those companies having transports exclusively on this distance did not participate in the survey.

Intermodal road-rail transports have an environmental advantage for freight shipped longer than 300 km and the results show that this represents a share of 40.3% of all freight shipped. Most of the freight volumes longer than 300 km are sent by large and medium manufacturing companies, both in relative terms within their strata and in absolute terms of total volume. The same two groups dominate on the longest transport distances (>600 km) whereas the small manufacturing companies have less volumes than the medium manufacturing companies, but more than the large wholesale companies. Among the rest of the groups of companies, the majority of their freight sent is shorter than this distance, especially for the wholesale companies.

This implies that the large and medium manufacturing companies generate the large goods volumes on the longer domestic distances, which is indeed very

interesting as potential freight for intermodal road-rail transports. Although intermodal road rail solutions are used today to a limited extent, this share may grow. These two groups of companies can be targeted through a focus strategy by segmentation. It is also worth discussing the average total weight shipped per year and company (see Table 6.1). The companies mentioned have large freight flows (36.1+200.5 thousand tons) but it is notable that large wholesale have large volumes per company (98 thousand tons) although the share of total goods volumes is not too impressive (11%). The opposite is true for small manufacturing companies; they have a substantial share of the total goods volumes (17,080) but it is divided among many companies so the average freight shipped per company is quite low (7.6 thousand tons). If this last mentioned group of companies would be a target group for marketing of intermodal road-rail transports, it is probably necessary to coordinate freight transport from many companies in consolidation points in order to be effective.

#### 6.1.4 Modes of transport used

The survey also looked at the modes of transports used (see survey question 13 in Appendix 3). Table 6.5 shows the transport modes used by shippers. As can be expected, almost all shippers use road transport to some extent (98%). Combinations of different modes are more rarely used regardless modes of transport, but it is mainly large- and medium-sized manufacturing companies that use intermodal transport. Train is mainly used by these groups too, but the small manufacturing companies also use train to a relative high extent (5.5%). Note that the table only shows if a mode is used by a shipper, not the weight distribution of freight volumes.

**Table 6.5 Proportions of shippers using different transport modes**

Stratum	Truck	Truck/ ship	Truck/ aircraft	Train	Ship	Truck/ train/ (ship) <sup>1</sup>
	%	%	%	%	%	%
Small manufacturing	98.2	5.5	5.5	5.5	3.6	3.6
Small wholesale	97.8	6.5	6.5	0	0	0
Medium manufacturing	98.8	25.2	16.9	8.1	5.8	12.2
Medium wholesale	96.1	7.7	11.5	0	1.9	5.8
Large manufacturing	96.7	36.4	28.9	28.1	15.7	19.8
Large wholesale	98.9	4.4	10.0	2.2	0	3.3
<i>Stratified mean (n=536)</i>	<i>98.0</i>	<i>9.2</i>	<i>8.6</i>	<i>3.2</i>	<i>2.3</i>	<i>3.7</i>

1) May also include ship when using detachable load carriers.

The group of companies that use intermodal road-rail transports to the largest extent (19.8%) is large manufacturing companies, see Truck/train/(ship) column in Table 6.5. Medium manufacturing companies is the second largest group where 12.2% of them use it. These two groups of manufacturing companies represent 37% (large one) and 24% (medium ones) of the estimated goods volumes in Sweden in the target population. Interestingly, it is only a share of 3.3% of the large wholesale companies that use these intermodal transports while their freight flows represent 11% of the estimated total freight. However, it should be noted that in many cases, the shipper is probably unaware of whether several modes are used in the transport chain. Intermodal road-rail transports may be used by large forwarders between their terminals, but the average shipper only knows that the freight is picked up and delivered by truck for consolidation, thus assuming that all-road transport is used. If this is a common perception, it may offer a marketing opportunity to point out when intermodal road-rail transports are used for increasing the attention for them among shippers.

In general, the shares of shippers that use intermodal transports are not impressive and this is a challenge in the marketing of these transports. There are possibilities of expanding these shares in the three groups of companies with the largest freight volumes. The utilization rate is especially low among large wholesale companies, although they represent an estimated 13 million ton equivalents of goods (11% of the total estimated freight) but only 3.3% of them use intermodal road-rail transports at present. It can be noted that the grade of utilization of train is also very low in this group (2.2%). The modes used also depend on the infrastructure available at the shipper which is seen in Table 6.6 (see survey question 10 in Appendix 3).

**Table 6.6 Proportions of shippers with various types of transport infrastructure**

Stratum	Loading ramp (for trucks)	Terminal surfaces (e.g. for positioning of containers)	Rail siding	Quay
	%	%	%	%
Small manufacturing	48.1	44.4	11.1	3.7
Small wholesale	47.8	45.7	6.5	0.0
Medium manufacturing	72.1	53.1	21.8	6.1
Medium wholesale	66.7	40.7	1.9	0.2
Large manufacturing	78.1	53.9	39.1	16.4
Large wholesale	84.8	39.1	23.9	3.3
<i>Stratified mean (n=536)</i>	<i>54.4</i>	<i>45.5</i>	<i>10.0</i>	<i>2.2</i>



Comparing the data to Table 6.5, the utilization degree of the rail sidings when they are available (Share of companies using 'Train' divided by share with 'Rail siding' in each stratum) can be calculated; a stratified average of 20% of the shippers with rail siding use them. The manufacturing companies have the highest utilization; 72% of the large ones and 37% of the medium-sized ones. It is only 9% of the large wholesale companies that use them, but the small and medium wholesale companies never do.

In order to use intermodal transports, it is necessary for the shippers to have a loading ramp i.e. certain types of infrastructure. If the frequency of the different transport infrastructure in the three groups of companies with most freight volume are put together (i.e. large companies along with medium manufacturing companies), the stratified average show that 75% of all these companies in Sweden have some kind of loading ramp, 52% have terminal surface, 25% have rail siding and 8% have a quay (not shown in Table 6.6 though). The utilization degree of the loading ramps for intermodal road-rail purposes (Share of companies using 'Truck/Train (ship)' divided by share with 'Terminal surfaces' in each stratum) show a stratified average of 8%. However, the larger manufacturing companies have much higher utilization degree; 37% for the large ones and 23% for the medium ones.

The shares of companies that have access to terminal surfaces e.g. for positioning of containers etc. give important information for intermodality. These shares are substantially higher in comparison to the shares of companies using intermodal road-rail transports in Table 6.5. This is an opportunity in the marketing of intermodal transports towards new users of these transports among shippers.

## **6.2 Relations with transport providers**

In order to see the structure of relationships with the transport providers, some questions about these issues were included in the survey. First, it is interesting to look at who perform the outbound freight transports which is seen in Table 6.7 (see survey question 5 in Appendix 3). In a majority of cases, 95% of all companies despite size, transport providers are contracted. The strata with least transport volumes contract transport providers to the highest extent i.e. the smaller wholesale companies (100%) along with the medium-sized wholesale companies (96.2%). However, Table 6.7 shows the shares of companies that to some degree apply certain transport solutions. Companies can have a diversity of solutions. For instance, a relative high share of the small companies have their own vehicles e.g. 26.3% of the small manufacturers. Manufacturing companies often have outbound transports organized by customer (e.g. "ex-works"

transports). Over half of the medium-sized manufacturers have such transports (50.8%). It is also worth pointing out that the larger wholesale companies also have a fairly high share of own transports (27.5%).

**Table 6.7 Proportions of shippers having their transports organized by transport providers, by themselves (rented or own/leased vehicles) and by customers**

Stratum	Contract transport providers	Organize own transports..		Customers organize the transports	Organize transports in other ways
	%	...with rented transport service %	...with own/leased vehicles %	%	%
Small manufacturing	91.2	21.1	26.3	33.3	1.8
Small wholesale	100.0	10.4	20.8	2.5	0.2
Medium manufacturing	91.6	17.3	5.6	50.8	1.7
Medium wholesale	96.2	15.1	15.1	3.6	3.8
Large manufacturing	89.9	24.0	16.3	35.7	1.6
Large wholesale	76.9	37.4	27.5	15.4	0
<i>Stratified average (n=557)</i>	<i>95.5</i>	<i>15.6</i>	<i>20.1</i>	<i>17.5</i>	<i>1.3</i>

This discussion about how the transports are performed leads to the contractual side of the relations with transport providers. These results are presented in Table 6.8 (based on the survey question 8 in Appendix 3).. The stratified average number of long-term transport contract is 3.2 contracts and some of those companies (127 companies out of 557) have contracts including other logistical services (e.g. ware-housing). The average number of these latter contracts is 1.3. The larger the company, the more contracts are used, and contracts also including other logistical services are used to a higher extent. The large manufacturing companies have the largest volume of goods, and at the same time their average number of long-term transport contracts of 11 is outstanding in comparison to the rest. In addition, they have an average of 3.1 contracts also including other logistical services. In sum, the larger companies with large freight volumes also have the longest contracts. However, their largest contract covers a lower share of their freight volume transported than among the other groups of companies. This signifies a type of risk diversion as it reduces the dependence on the main transport provider.

**Table 6.8 Average number of long-term contracts and of those including other logistical services; length and proportion of freight in largest contract.**

<b>Stratum</b>	<b>Number of long-term transport contracts</b> (n=518)	<b>Number of contracts incl. other logistical services</b> (n=127)	<b>Length of largest contract, Yrs</b> (n=442)	<b>Proportion of freight volume transported in largest contract, %</b> (n=436)
Small manufacturing	2.5	1.1	1.3	69.0
Small wholesale	2.7	1.3	1.1	71.0
Medium manufacturing	5.7	1.5	1.7	59.6
Medium wholesale	2.6	1.1	1.6	73.7
Large manufacturing	11.0	3.1	2.0	47.8
Large wholesale	7.1	1.6	2.1	52.6
<i>Stratified average</i>	3.2	1.3	1.3	68.7
	+/-0.5	+/-0.1	+/-0.1	+/-4.4

The relationships with transport providers discussed in this section have related mainly to the formal aspects of the relations i.e. contracts. There are also more informal aspects of these relations e.g. trust. Some of these are discussed in the following section regarding priorities when shippers select transport providers.

### **6.3 Top priorities when shippers select transport provider**

In order to describe the demand, it is crucial to examine what the shippers rank highest when selecting a transport provider i.e. their priorities. Table 6.9 shows the average weight the respondents attribute to each item proposed in this choice (see survey question 24 in Appendix 3 or 4 for the full list of the total 33 items), where the 16 most highly valued are shown. In that sense, it can also be described as what the shippers expect from their transport providers.

**Table 6.9 The Top 16 quality items (out of 33) ranked highest (> 5.0) in importance when shippers select transport providers**

	<b>The transport provider...</b>	<b>Strati- fied mean*</b>	<b>+/-</b>	<b>n</b>
1	...fulfills its commitments	6.399	0.162	527
2	...performs transports in time agreed upon	6.395	0.166	528
3	...covers our market area geographically in a sufficient manner	6.265	0.150	527
4	...is easily accessible regarding inquiries and bookings	6.258	0.183	526
5	...keeps a consistent quality level	6.087	0.145	517
6	...knows how to handle our freight in order to avoid damages	5.840	0.209	527
7	...is easily accessible regarding follow-up of transports	5.830	0.194	510
8	...can offer custom-made transport solutions	5.754	0.222	522
9	...has friendly employees at collection and delivery of freight	5.743	0.183	522
10	...can adjust to large variations in volumes	5.695	0.222	522
11	...offers one of the lowest prices	5.674	0.198	524
12	...can make deliveries at short notice	5.637	0.225	524
13	...has a good reputation	5.552	0.187	518
14	...has safety routines against theft and loss	5.497	0.227	513
15	...has well functioning routines for reporting deviations	5.369	0.202	520
16	...has good routines for handling documents	5.209	0.206	518

\* The range is 1-7, where 1 equals “a very small weight” and 7 equals “a very large weight”

The highest rated item (“transport provider fulfills its commitment”) relates to reliability and trust in a business-to-business relationship (another example is “has a good reputation” ranked 13). The second highest rated item (“performs transport in time agreed upon”) has to do with timeliness, but also reliability. The item on third place (“covers our market area geographically in a sufficient manner”) is related to capacity or network resources. The item “Offers one of the lowest prices” ranks 11, which indicates that price is important but other service factors are generally speaking considered to be more crucial. This will be discussed further in Section 6.4 and compared to trade-offs between price, transport time, on-time delivery, and environmental efficiency.

In the list of the 16 top priorities, none of the items relating to environmental aspects appears (that were included among the 33 original items). The one item

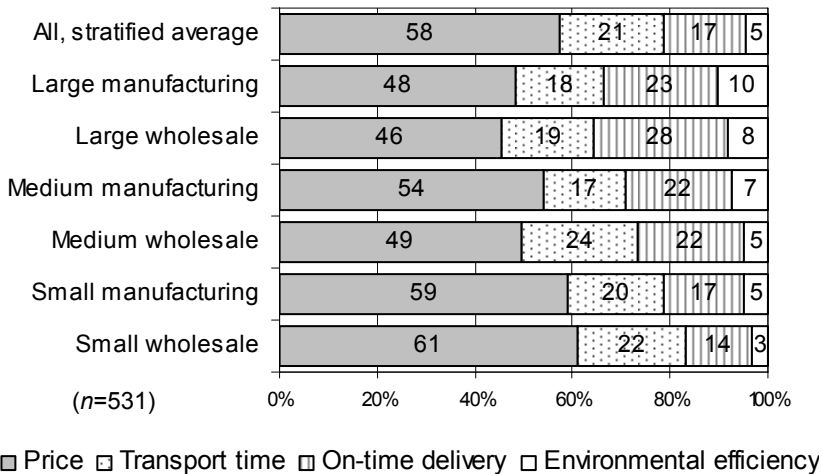
that the received the highest ranking among those in connection to environmental considerations, was ranked 20 (“has environmentally efficient transports”). This does have implications for the marketing of environmentally preferable transports by using environmental demands e.g. intermodal road-rail transports. Since freight transport market as a whole might not be ready for this type of marketing, a further segmentation based on environmental priorities is needed.

An additional analysis was done based on the ranking per strata instead (see Appendix 5). A clear majority of all companies, regardless of size, have the same six top priorities when choosing a transport provider. All companies ranked among the top three priorities that the transport provider “performs in time agreed upon” and “fulfills its commitments”. It appears that the wholesale companies give higher ranking to geographical coverage (ranked on second or third place) than the manufacturing companies do (ranked on 4<sup>th</sup> place or  $\geq 6^{\text{th}}$  place). Appendix 5 also contains an additional analysis of results concerning on-time deliveries (ranked on second place) and damaged goods (relates to items ranked on fourth and sixth place; “keeps a consistent quality level” and “knows how to handle our freight in order to avoid goods damages”). These results show that the on-time delivery rate is quite high, approximately 92-94% to European destinations. The share of damaged goods is about 1.5% of all freight volumes transported.

Note that the respondents also were asked how content they were with their main, current transport provider. The gaps between the importance and the fulfillment of these qualities i.e. their satisfaction will be analyzed in Section 8.2.

## **6.4 Trade-offs with environmental aspects**

In a purchasing situation, there are certain trade-offs that a transport or logistics manager has to do. The respondents were asked to distribute 100% among four factors according to their importance when their local unit selects transport solution for their outbound transports: price, transport time from door-to-door, on-time delivery from door-to-door and environmental efficiency (represented by CO<sub>2</sub>-emissions). The results are shown in Figure 6.1 (based on the survey question 9 in Appendix 3).



**Figure 6.1 Distribution of 100% between price, transport time, on-time delivery and environmental efficiency when selecting transport solution.**

Price was valued highest of the four factors and its importance decreased with an increased size of the company. Transport time was more critical to smaller companies and medium wholesale companies, than to those with more than 100 employees. The reverse relation is valid regarding on-time delivery, where the large companies valued this highest. In total, the Swedish manufacturing and wholesale companies attribute 58% of the weight to price, 21% to transport time, 17% to on-time delivery and 5% to environmental efficiency. It can also be seen that the price is more important for smaller companies and environmental aspects are more important for larger companies.

An interesting comparison regarding price can be made with Table 6.9, where price is only ranked at 11<sup>th</sup> place while on-time deliveries are ranked as number one. The difference is that in Table 6.9, the respondents were asked how important it was that the transport provider has “one of the lowest prices”, whereas in Figure 6.1 the question only regarded the weight given to price. These two questions also differed from each other in another sense, since Table 6.9 aimed at the choice of transport provider, whereas Figure 6.1 target the choice of transport solution. The latter does not have to include the choice of transport provider. However, a conclusion can be drawn; price is a very important aspect but it does not have to be necessarily one of the lowest prices. This can be compared to the discussion in Section 6.3 (but also in Section 5.4.1. in the interview

study results) about the different aspects where price is important when basic requirements are fulfilled.

The different groups of companies can be analyzed on basis of the attributed importance of environmental efficiency: the large manufacturing companies ranked it the highest followed by large wholesale companies and medium manufacturing companies. The same conclusion from this question can be drawn among all groups of companies; price was given the highest priority and the environmental aspect the lowest. In research, the willingness to pay for environmental concern is of great interest, but a problem is finding the proper research methods to explore this issue. The results displayed in Figure 6.1 may however provide an indication of the willingness to pay for environmental improvements of the shippers' freight transports. This was done by calculating the quota between the points attributed to environmental efficiency divided with the points attributed to price, see Table 6.10.

**Table 6.10 Willingness to pay for environmental considerations of transports**

<b>Stratum</b>	<b>Environmental efficiency &amp; price ratio</b>
Small manufacturing	0.12
Small wholesale	0.07
Medium manufacturing	0.21
Medium wholesale	0.15
Large manufacturing	0.33
Large wholesale	0.26
<i>Stratified mean (n=525)</i>	<i>0.12</i>

The rank order of the top three is the same as when they attributed environmental efficiency, see above. However, two other groups of companies differentiated somewhat now, even if they before had attributed the same points to environmental efficiency (i.e. 5). The calculated ratios show now that the medium manufacturing companies has a higher one (0.21) in comparison to the small manufacturing companies (0.12). This is due to the price sensitivity of the companies. Those who scored highest on importance of environmental efficiency were the least price sensitive groups, as seen in Figure 6.1. Once again, it is the large manufacturing companies in the lead (0.33) followed by the large wholesale companies (0.26) and then the medium manufacturing companies (0.21). According to these results, these groups would be most receptive for environ-

mental marketing arguments since they are willing to pay a price premium for an environmentally preferable transport service.

A closer look was also taken on the manufacturing companies in order to find differences between the different trades of business (see Table 6.11). They were divided into the following five generic groups: Foods/beverages /tobacco, Woods/pulp/paper, Chemicals/Printing/Publishing, Metal/machinery/equipment and Other manufacturing.

**Table 6.11 Willingness to pay for environmental considerations of transports, divided on trades of business**

Stratum	Food, beverages, tobacco	Wood, pulp, paper	Chemicals, printing, publishing	Metal, machinery, equipment	Other manufacturing	Range (exception)
Small manufacturing		0.03*	0.12	0.12	0.18	0.12-0.18
Medium manufacturing	0.15	0.16	<b>0.34</b>	0.22	0.10	0.10-0.22 (0.34)
Large manufacturing	0.33	0.35	<b>0.19</b>	0.35	0.41**	0.33-0.35 (0.19)
<i>Stratified average (n=342)</i>	<i>0.19</i>	<i>0.08</i>	<i>0.18</i>	<i>0.16</i>	<i>0.17</i>	<i>0.16-0.19 (0.08)</i>

\* Based on only 4 companies. The relative high importance of this stratum in the stratified average (i.e. large number of companies) made it lower than in the other trades of business (0.08)

\*\* Based on only 4 companies

The analysis showed that size of company had a greater impact on the ratio than trade of business. One trade of business was somewhat different than the others, the Chemical/Graphical industry, where the ratio was higher among the medium-sized companies and lower among the large ones (marked in bold in Table 6.11). Another comparison was made between the willingness to pay for environmental considerations among companies that had implemented an EMS, with companies without one. The results are displayed in Table 6.12. The companies that had implemented an EMS had a higher willingness to pay for environmental considerations than the average company, regardless size. The companies with an EMS implementation had a ratio of 0.16 while those without one had an average ratio of 0.08. The stratified average among all companies calculated before showed a ratio of 0.12.



**Table 6.12 Willingness to pay for environmental considerations of transports, divided on companies with and without an EMS**

Stratum	All	EMS-implementation?	
		Yes	No
Small manufacturing	0.12	0.14	0.06
Small wholesale	0.07	0.11	0.05
Medium manufacturing	0.21	0.23	0.22*
Medium wholesale	0.15	0.22	0.08
Large manufacturing	0.33	0.36	0.38*
Large wholesale	0.26	0.29	0.20*
<i>All, stratified mean</i>	<i>0.12</i>	<i>0.16</i>	<i>0.08</i>
<b>n</b>	525	331	74

\* Based on less than 10 companies.

The differences between those that had implemented an EMS and those without one, were greatest among the three groups of companies with less than 100 employees. In the two groups with small companies, the willingness to pay ratio was more than twice as high among those with an EMS than among those without one (0.14/0.06 and 0.11/0.05). Among the medium wholesale companies, this ratio was almost three times as high (0.22/0.08). There was a difference also among the large wholesale companies but a more moderate one (0.29/0.20). Interestingly, the differences were quite small between those with an EMS and those without one among the medium and large manufacturing companies. It was even a slightly higher ratio among the manufacturing companies without one (0.38) than among those with an EMS (0.36). The comparisons among the companies with more than 100 employees should however be interpreted with caution, since the figures among those without an EMS are based on few cases (<10).

## 6.5 Summary

The total freight shipped in Sweden among companies having transports exceeding 150 kilometers (the assumed lower limit for intermodal transports) was estimated to 119 million ton equivalents, based on the resulting volumes in the conducted survey. 72% of the tonnage was attributable to local units with at least 100 employees. More than half of the transport flows are within Sweden and about 40% of the domestic freight are long distance (over 300 km). However, it can be noted that the longest transport distances (>600 km) are generated by large and medium manufacturing companies. The small manufacturing

companies have smaller volumes transported than the medium manufacturing companies, but larger volumes than the large wholesale companies at the longest transport distances (>600 km).

Most of the freight generated by the wholesale companies is shipped domestically; over 80% regardless size. The small manufacturing companies as a group have a substantial share of the domestic flows (14%) but the large domestic freight volumes are generated by the manufacturing companies (and to some extent also by the large wholesale companies). Even so, the large manufacturing companies ship only a bit over 1/3 of their freight within Sweden.

Most exports are conducted by manufacturing companies, particularly for more distant destinations outside the Nordic countries. About 10% of the freight is shipped to our neighbouring countries Norway, Denmark and Finland, where Norway has the largest share (4% of the freight). The terminals of intermodal road-rail transports in Norway and Sweden are shared in the same company (CargoNet) so coordination should work fairly easy. The rest of Europe represents 22% of all freight sent which is a substantial amount where the large and the medium manufacturing companies are dominating (with 85%) of all freight. These transports have a distance that would fit intermodal road-rail transports well. The rest of the world has a share of about 11% but it can be assumed that a large share of freight are shipped by boat. Even so, this freight could be suitable intermodal (road)-rail-ship freight since it needs to be transported to and/or from a port.

The statistics showing the groups of companies that generate the freight flows on different transport distances, have large implications for transport providers when they differentiate their transport services. Long-distance transport providers (particularly of international transports) need to have good knowledge of the needs of especially the large and medium manufacturing companies. The large wholesale companies and small manufacturing companies are also of interest for domestic transport providers. These groups of companies are the most interesting target groups for marketers of intermodal road-rail transports in this respect.

The dominant mode of transport is truck, and almost all shippers use road transport to some extent (98%). Combinations of different modes are more rarely used, especially road-rail transports (4%). The large manufacturing companies use it to the highest extent and have a substantial share of their transports by this combination of modes (22%). However, these statistics should be interpreted with care as the shipper probably does not always know when several modes are

used, since the choice of transport mode is often made by the transport provider. Regarding the infrastructure at the shippers, loading ramps or terminal surfaces are prevalent. As loading ramps (the usage varied largely between groups of companies; 48%-85%) and terminal surfaces (used by 39%-54% of the groups of companies) are needed for trucks and to position containers etc., this is an important pre-requisite for using intermodal road-rail transports. This is an opportunity for increasing the market share with new customers and expanding the customer base.

In a majority of companies (95%) transport providers are contracted. Strata with least transport volumes contract transport providers to the highest extent and a higher share of their freight volume is covered by their largest contract i.e. main transport provider. The survey results show that the larger the company, the more contracts are used and contracts also including other logistical services are used to a higher extent.

The most important aspects that influences the shippers' choice of a transport provider, and thereby the transport solution, were similar for all categories of companies. All companies ranked among the top three priorities that the transport provider "performs transports on time agreed upon" and "fulfills its commitments". Items relating to environmental aspects of the transports were not among the top 16 priorities (out of a total of 33 items) among shippers. However, "fulfills its commitments" may very well include environmental commitments as well, depending on how the respondents interpreted this item. This is impossible to validate at this stage though. This is a barrier for marketing of environmentally preferable transports e.g. intermodal road-rail transports. This can be dealt with through segmentation of the market and to identify companies that value environmental aspects to the highest extent. Based on this, it is then possible to consider a transport service differentiation to various segments.

The on-time delivery rate is quite high, but in certain industries these levels may not be acceptable depending of how critical the deliveries are for the customers. The share of damaged goods seemed low as well Price dominates when trading off price, transport time, on-time delivery, and environmental efficiency when choosing transport solution. Price is also more important for smaller companies, whereas time factors and environmental aspects are more important for larger companies. Interestingly, "to have one of the lowest prices" is not one of the basic requirements, although the respondents give price on average a 58% "weight" when selecting transport solution. Price is important, but it does not have to be one of the lowest prices, as it is more important that the basic transport requirements are met, at least for some categories of companies.

Another possible basis for segmentation can be price sensitiveness among shippers. The willingness to pay for environmental improvements of the shippers' freight transports was done by calculating the quota between the points attributed to environmental efficiency divided with the points attributed to price. Those who scored highest on importance of environmental efficiency turned out to be the least pricesensitive groups. There is a higher willingness to pay for environmental considerations among companies with more than 100 employees, with large manufacturing companies in the lead followed by large wholesale companies and then by medium manufacturing companies. These groups would be most receptive for environmental marketing arguments. This is an opportunity for using environmental arguments in the marketing of intermodal road-rail transports.

The size of the manufacturing companies had also a greater impact on the willingness to pay, than their trade of business. Among the medium and large manufacturing companies, the differences were small between those with an EMS and those without one. The companies with less than 100 employees are more price-sensitive, but those with an EMS show a much greater willingness to pay i.e. the ratio between environmental efficiency and price was 2-3 times higher in comparison to those without an EMS. An implemented EMS is therefore an indication on a higher receptiveness for environmental arguments among companies with less than 100 employees, if these companies are to be included in a marketing program.

The results presented in this chapter have provided a necessary knowledge base as a part of a market analysis and a customer analysis of intermodal road-rail transport. This can be used further on in this thesis e.g. when examining a potential transport service differentiation. The opportunities and barriers of the marketing of these transports have also been discussed. Environmental aspects were included in a first analysis regarding trade-offs with other important aspects. However, the environmental considerations among the shippers need to be examined more in detail; both their general environmental work and in relation to their transports. The next chapter will look at these issues in terms of the existing measures and pressures for reducing environmental effects.

## **7 Measures and pressures for reducing environmental effects –survey results**

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The environmental considerations among shippers are vital for the purpose of this thesis, especially in relation to the first research question; what impact do environmental aspects have on shippers and their customers? This chapter reveals the progress of environmental measures and pressures for reducing the environmental effects of freight transports among Swedish shippers, based on the results of the conducted survey. This chapter shows results in relation to:

- Implemented environmental measures
- The existence of internal pressures; Corporate Environmental Policy and Environmental Management Systems
- The effects of the Corporate Environmental Policy on the transport planning
- The importance and possibility of implementing environmental measures
- The existence of pressures affecting the choice of transport mode

The measures in focus relate to those within the control of the companies (e.g. environmental management tools), rather than on external measures (e.g. political decisions, taxes). The pressures investigated are internal ones, i.e. from the own company, but also external ones from customers. This chapter is structured around the themes described above, but it is interesting to initially look at what the shippers thought were the most serious problem of their transports.

### **7.1 Opinions of environmental problems**

Politicians talk in broad terms about sustainability, but what do shippers consider as negative environmental consequences of their transports? An open-ended question was included in order to see what the respondents considered to be the most negative environmental effects from their transports (see survey question 29 in Appendix 3).. The highest frequencies received “emissions”

(43%) and the second most common was identified by merging together the “carbon dioxide/green house effect/gases” (34%). Emissions may very well also cover emissions of carbon dioxide, which implies that the respondents identifying this as the most negative environmental effect may very well be much higher than 43%. Effects like NO<sub>x</sub>, low loading factor, noise, congestion, accidents etc. received very low frequencies. In sum, there was awareness of the problem relating to the greenhouse effect which is identified as a major problem from society’s point-of-view. The next step is to take a closer look at what the companies have done by looking at the implemented measures for environmental improvements also affecting the freight transports.

## 7.2 Implemented measures

This section presents what measures for reducing environmental effects that are most commonly implemented in general among shippers. The respondents were faced with 18 different measures (items) related to environmental aspects, especially in connection to freight transportation (see survey question 30 in Appendix 3). The results of the ranking are shown in Table 7.1.

The ‘Stratified means’ show the share all companies in Sweden having freight transports exceeding 150 km that have implemented each measure. The results clearly show that the most common one is to implement a Corporate Environmental Policy (CEP) in the company. After that, acquiring an Environmental Management System (EMS) along with the appointment of an environmental manager/department are the most frequent measures. One conclusion is that the measures most commonly used are connected to the company as a whole in the field of environmental management, and not measures specific to the transportation area. The most common measure specific to transportation implemented was ranked at the 8<sup>th</sup> place; the use of trucks equipped with engines of high environmental standards. This is a measure that is automatically made if the truck park is renewed e.g. every 3-5 years and cannot be considered as a strong environmental commitment. Nevertheless it affects the environment in a positive way. This measure was followed by a range of the transport-specific measures in the ranking relating to loading (to increase the load factor, to reduce empty loads), to co-operation (with transport provider, suppliers and customers) and to environmental demands (on outbound transports and inbound transports). In many cases, the measures related to loading require freight transport planning and induce an economic incentive to implement them as they also reduce costs of transport.

**Table 7.1 The ranking of implemented environmental measures and their proportions, as stratified averages per item**

<b>R A N K</b>	<b>Implemented environmental measures:</b>	<b>Stratified mean %</b>
1	To implement a Corporate Environmental Policy in our company	30.2
2	To get an Environmental Management System (EMS) certification	21.2
3	To appoint an environmental manager/department	19.4
4	Increased co-operation with the person responsible for environmental issues in our company	15.3
5	More education in environmental issues	13.0
6	To publish Corporate Environmental Reports	11.9
7	Increased support for environmental priorities from Senior Management	9.1
8	To use trucks equipped with engines of high environmental standards	9.0
9	To increase the load factor of goods	6.0
10	To reduce empty loads/to increase return transports of freight through e.g. shared deliveries with other companies	5.8
11	Increased co-operation in environmental issues with transport provider/forwarder	5.8
12	Increased co-operation in environmental issues with suppliers	5.0
13	Put stricter environmental demands on our outbound transports	4.2
14	Put stricter environmental demands on our suppliers' transports to us	4.1
15	Increased co-operation in environmental issues with customers	1.5
16	To use other alternative fuels than diesel e.g. bio-fuels, gas	1.2
17	To transport more of our freight on rail	0.6
18	To use more intermodal freight transports truck-rail	0.6
19	Other.....	0.1

These results show that measures relating to transports are still in their infancy in comparison to the more established environmental management tools e.g. CEP and EMS. Their share was higher among the respondents in the survey than the stratified shares representing all companies in the target group in Sweden, since it was probably not as common in the small companies as in the larger ones (which were over-represented in the survey). This demanded further analysis of the implemented measures based on strata, in order to see the differences based on size of company. The results divided on strata are seen in Table 7.2.

**Table 7.2 The Top 6 most commonly implemented measures among all shippers in the target population (%)**

<b>RANK</b>	<b>Stratified Total</b>	<b>Small Manufacturing</b>	<b>Small wholesale</b>	<b>Medium Manufacturing</b>	<b>Medium wholesale</b>	<b>Large Manufacturing</b>	<b>Large wholesale</b>
<b>1</b>	To implement a CEP 30%	To implement a CEP 28%	To implement a CEP 21%	To implement a CEP 55%	To implement a CEP 33%	To implement a CEP 76%	To implement a CEP 62%
<b>2</b>	To get an EMS certification 21%	To get an EMS certification 22%	To get an EMS certification 12%	Appoint an environm. dept. 50%	Appoint an environm. dept. 24%	Appoint an environm. dept. 70%	Appoint an environm. dept. 57%
<b>3</b>	Appoint an environm. dept. 19%	Appoint an environm. dept. 18%	Increased environm. education 9%	To get an EMS certification 48%	To get an EMS certification 18%	To get an EMS certification 64%	To get an EMS certification 45%
<b>4</b>	Increased co-operation w/ environm. dept. 15%	Increased co-operation w/ environm. dept. 18%	To publish a CER 9%	Increased co-operation w/ environm. dept. 28%	Increased co-operation w/env. dept 18%	To publish a CER 49%	Increased environm. education 37%
<b>5</b>	Increased environm. education 13%	Increased environm. education 12%	Appoint an environm. dept. 7%	To publish a CER 27%	Increased environm. education 12%	Increased co-operation w/ environm. dept. 48%	Increased co-operation w/ environm. dept. 27%
<b>6</b>	To publish a CER 12%	Increased support from Senior Man. 12%	Increased co-operation w/ environm. dept. 7%	Increased environm. education 24%	Increased co-operation w/ environm. dept. 10%	Increased environm. Education 30%	To publish a CER 24%

Undoubtedly, the most common measure implemented regardless of the size of company, was a CEP that 30% had implemented but a much higher share among the companies with heavy transport volumes (55%, 76%, 62%). In fact, this was the case in all of the six most common measures i.e. these three strata have considerably higher shares of implementation than what the stratified average shows. Their transports affect the environment to the highest extent, so that the cumulative importance of the implemented measures should be notable on nature due to their large freight volumes.

The results showed that the two of the three most commonly implemented measures regardless company size were the implementation of a CEP and an



EMS certification. Other common practices were appointing an environmental department, increased co-operation with the environmental department/ responsible, increased environmental department and publishing a Corporate Environmental Report (CER). In all these measures, the environmental function in each company has a key role. In fact, an environmental department was the second most common measure among medium and large companies. It is worth exploring the two most common measures more in depth; the CEP and EMS. These will be analyzed in the next section.

### 7.3 Internal pressures: CEP and EMS

A Corporate Environmental Policy (CEP) and an Environmental Management System (EMS) are general management tools that may influence the environmental aspects of freight transportation. They can be considered as internal pressures for environmental improvements. Separate survey questions on these tools were included in order to explore to what extent the companies had implemented them or were in the process of implementation (see survey questions 25 and 26 in Appendix 3). The results are presented in Table 7.3.

**Table 7.3 Proportions of how many local units that have implemented, or are in the process of implementing, a CEP and/or an EMS**

Stratum	A CEP...			An EMS...		
	...is already implemented	...is being implemented	Both together, (N=492)	...is already implemented	...is being implemented	Both together, (N=513)
	%	%	%	%	%	%
Small manufacturing	48	31	79	24	29	53
Small wholesale	37	9	46	16	24	40
Medium manufacturing	77	17	94	61	26	87
Medium wholesale	48	4	52	25	16	41
Large manufacturing	92	3	95	75	16	91
Large wholesale	74	16	90	55	22	77
<i>Stratified average</i>	<i>48</i>	<i>16</i>	<i>63</i>	<i>26</i>	<i>24</i>	<i>51</i>

An average of 48% of the Swedish companies had implemented a *Corporate Environmental Policy (CEP)*, although there were great variations between the different strata. A few conclusions can be drawn. Firstly, there was a much higher degree of implementation in manufacturing companies (48%, 77% and

92%) than in wholesale companies (37%, 48%, and 74%) regardless the size of companies. Secondly, the shares were considerably higher among companies with more than 100 employees (92%, 74%, and 77%), representing the largest volume of goods. The respondents could also state if their companies were in the process of implementing a CEP, in order to give an indication of the dynamics in time. It is important to note that about half of the small manufacturing companies had one (48%), but a considerable share (31%) was in this process of implementing one. This may imply that there is a push for having a CEP from customers in the larger manufacturing companies towards the smaller supplying companies. There was also a substantial share in the implementation process among large wholesale companies (16%) and medium manufacturing companies (17%).

It can first be noted that all companies that implemented an *EMS* had probably already implemented a CEP i.e. the shares of companies having a CEP were higher than having an EMS in all groups. About a quarter of companies in the target population (26%) had implemented an EMS, and about the same share (24%) was in the process of doing so. The shares were higher in the medium- and large-sized manufacturing companies (61% and 75%) and in the large wholesale companies (55%). This is probably because these companies often have dedicated environmental departments, and more resources put into environmental issues. When looking at the groups of companies that were still in the implementation process, the small- and medium-sized manufacturing companies dominate (29% and 26%), but it is very common also in the small wholesale companies (24%). It can be concluded that companies with more than 100 employees and representing the largest volume of goods, had either implemented or were in the process of implementing an EMS to the highest extent (77-91%). It was also obvious (not shown in the table) that a clear majority of all companies that had implemented one, or was in the process of implementation, had chosen ISO 14001 (92%). EMAS had a very small share (6%), of which 3/4 of these companies had implemented both systems. The rest had implemented other kinds of EMS, specific for the company or their industry (6%).

It can also be noted that this section reported higher frequencies with regards to CEP and EMS than those reported in Section 7.2, where the stratified averages showed that 30% of all Swedish companies in the target population had implemented a CEP and 21% an EMS. The differences in the strata were quite small regarding the EMS but greater regarding a CEP. One explanation could be the difference in response rate between the questions. The higher shares reported in this section are based on much higher frequencies (n=492 on CEP and n=513 on EMS) than in Section 7.2 (n=269 on CEP and n=259 on EMS) i.e. almost twice as many have responded. Therefore, the reported shares in this section should

be more reliable. Even if the reported shares of CEP and EMS in Section 7.2 were lower, they were still among the most commonly implemented measures. The next question is whether a general management tool such as a CEP makes any difference with regards to the shippers' freight transports.

## 7.4 Effects of CEP on transports

The respondents that had a Corporate Environmental Policy (CEP) in their company, or were in the implementation phase, were asked to state to what extent it affected the transport planning (see survey question 26c in Appendix 3). Their attitudes could be expressed in seven alternatives, from "to a very low extent" (1) to "to a very high extent" (7). The results are seen in Table 7.4.

**Table 7.4 The proportions of respondents according to their judgments on the extent to which the environmental policy affects the transport planning**

Influence Stratum			To a very high extent	To a high extent	To a quite high extent	To a neither high or low extent	To a quite low extent	To a low extent	To a very low extent
	n	Mean	%	%	%	%	%	%	%
Small manufacturing	33	3.3 (+/-1.6)	0	3	27	24	9	15	21
Small wholesale	19	3.3 (+/-1.6)	0	0	26	37	0	16	21
Medium manufacturing	138	4.1 (+/-1.7)	5	15	25	26	10	8	12
Medium wholesale	25	4.5 (+/-1.4)	8	20	16	32	16	8	0
Large manufacturing	107	4.4 (+/-1.5)	5	21	26	24	16	3	6
Large wholesale	71	4.2 (+/-1.4)	3	16	27	23	24	6	3
<i>All, stratified average</i>	<i>393</i>	<i>3.6 (+/-0.3)</i>	<i>1.8</i>	<i>5.9</i>	<i>25.0</i>	<i>30.9</i>	<i>6.6</i>	<i>13.2</i>	<i>16.6</i>

A majority of the respondents stated that the CEP affected the transport planning "to neither a high nor low extent" today (30.9%) but the stratified average was 3.6. It was considered to a lower extent for the smaller companies (about 3.3 in average i.e. closer to "to a quite low extent"). The respondents in large- and medium-sized companies believed that the CEP affected the transport planning to the greatest extent (rated 4.1-4.5). It is quite surprising that the medium-sized wholesale companies rated the influence the highest, and most frequently of all groups as "to a very high/high extent", since only about half of them (48%) have a CEP i.e. a low share. One explanation can be that those who actually have carried through a CEP have succeeded better with their logistics adap-

tation than in the strata with companies with large transport volumes. It is of course easier to accomplish improvements if the transported volumes are small and less complex. Many times, this is taken care of by the transport providers appointed.

## 7.5 Importance and possibility to implement measures

After the results of what measures have been implemented, it is time to take a closer look at the attitudes among the transport-buying respondents about these measures. The respondents were asked to rate the **importance** of the same 18 measures as before in order to reduce the environmental impact of their transports, and also their opinions of the **possibility** for implementation (see Section 7.2 and survey question 30 in Appendix 3). A seven-degree semantic differential scale was used, where 1 equaled “very low importance” and 7 “equaled very high importance”. If a measure was already implemented, they did not grade the possibility to implement it.

A factor analysis, a principal components analysis (PCA), was conducted including all strata of companies on the importance of implementation. Firstly, the suitability of data for factor analysis was tested and supported<sup>40</sup>. The orthogonal factor rotation using Varimax with Kaiser Normalization, led to the identification of five factors, which explained 75.6% of the variance<sup>41</sup> and were retained after Catell’s scree test. The factors were named: ‘Intra-organizational measures’, ‘Inter-organizational measures’, ‘Outbound transports’, ‘Modal choice’ and ‘Load factors’, see Table 7.5. Their means as summated scales at the bottom of the table express the rated importance of each factor and the possibility for implementation respectively.

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<sup>40</sup> The correlation matrix revealed the presence of coefficients of .3 and above. The KMO value was .91. Barlett’s Test of Sphericity reached statistical significance, supporting the factorability of the matrix.

<sup>41</sup> Three components with eigenvalues exceeded 1 (explaining 47.0%, 12.2% and 6.4% of the variance) and further two were just below 1 (0.97 explaining 5.4%, and 0.84 explaining 4.7%).

**Table 7.5 The five groups of factors extracted from a Varimax rotation of the initial 18 variables (n=505), presented as summated scales with mean**

<b>Measure</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>	<b>Factor 5</b>
	<b>Intra-organizational measures</b>	<b>Inter-organizational measures</b>	<b>Out-bound transports</b>	<b>Modal choice</b>	<b>Load factors</b>
Get certified by an EMS e.g. ISO 14001	0.83				
Appoint an environmental manager/environmental function	0.78				
More education in environmental issues	0.72				
Introduce a CEP in our company	0.71				
Increased co-operation with the person on the internal environmental function	0.69				
To publish environmental reports	0.67	0.41			
Increased support for environmental priorities from senior management	0.67				
Increased co-operation in environmental issues with suppliers		0.78			
Increased co-operation w/ customers in environmental issues		0.77			
Increased co-operation in environmental issues with transport providers	0.42	0.65			
Put higher environmental demands on our suppliers' transports to us		0.62			
Use trucks with engines with high environmental standards			0.85		
Put higher environmental demands on our outbound transports			0.81		
Use other combustions than diesel e.g. bio-fuels, gas			0.66		
To transport more of our freight on rail				0.92	
To use more intermodal truck-rail transports				0.91	
To increase the loading of our vehicles (loading factor)					0.88
Diminish empty transports/increase return transports e.g. coordinated deliveries					0.85
<i>Eigenvalue</i>	8.35	2.22	1.15	0.98	0.85
<i>% of variance explained</i>	24.81	15.98	13.39	11.26	10.12
<i>Importance of measure, Mean (Summated Scale)</i>	4.62	4.84	5.35	4.33	5.30
<i>Possibility for implementation, Mean (Summated Scale)</i>	4.06	4.30	4.19	2.60	3.97
<i>Difference in importance and possibility</i>	0.56	0.54	1.16	1.73	1.33

Note: The factor loadings less than .4 are not shown

Starting with the importance of each factor, the respondents rated 'Outbound transports' (5.35) and 'Load factors' (5.3) the highest i.e. factors relating to freight transports particularly. These are tangible measures for logistics managers as well as the one on third place Inter-organizational measures (4.84). The least importance was attributed to the commonly implemented measures in 'Intra-organizational measures' (4.62) and 'Modal choice' (4.33). The respondents were also most pessimistic about 'Modal choice' when it came to the possibility for implementation (2.6) and this factor also had the largest gap between the importance and possibility for implementation where the importance was rated much higher (+1.73).

Generally, it is evident that there were gaps in all factors, as the respondents assigned more weight to the importance of measures than the possibility to implement them. It is worthwhile to investigate these differences more in depth, not just look at the total mean scores. The hypothesis formulated is that the attributed importance of each factor is distinctively higher than the possibility of implementation. Paired t-tests of summated scales based on the factors from the factor analysis were conducted to identify gaps among the companies with more than 100 employees, between how each respondent rated the importance and the possibility for implementation.

However, the  $n$  turned out small in these earlier tests (e.g.  $n$  was only 16 among the large manufacturing companies) as many companies had already implemented these measures included and thus, did not rank the possibility of implementation. Section 7.2 discussed these implemented measures. In this first test, those who had implemented these measures were not taken into account which was too approximate since the test did not use the data sufficiently and distorted the results. Therefore, a second test also included those companies that had already implemented the measures. The already implemented measures could be considered as at least the same value as the largest possibility for implementation (7), or even worth more, since these have already been implemented. Therefore these were rated to the theoretical value of 7.001 in this analysis instead of being excluded as missing values, which increased the  $n$  in these paired t-tests. However, these should in reality be rated higher than this theoretical value, but it is difficult to establish a 'real' value. The results of the paired samples t-tests are shown in Table 7.6. Due to the low theoretical value on the already implemented measures, the table show minimum significance levels which probably would be lower if a 'real' value could be established.

**Table 7.6 Paired samples t-tests between rated importance and possibility of implementation of each factor among companies with > 100 employees**

<b>Stratum</b>		<b>Factor 1: Intra- organiza- tional measures</b>	<b>Factor 2: Inter- organiza- tional measures</b>	<b>Factor 3: Outbound transports</b>	<b>Factor 4: Modal aspects</b>	<b>Factor 5: Load fac- tors</b>
Large wholesale (n=53-79)	<i>Means</i>	4.99- 5.37	5.00- 4.43	5.57- 4.80	4.15- 2.23	5.48- 4.12
	<i>Gap</i>	-.38	.57	.77	1.91	1.36
	<i>T</i>	-2.50	3.97	5.06	8.78	7.21
	<i>Sign.</i>	.016 (.008)	.000	.000	.000	.000
Large manufacturing (n=69-105)	<i>Means</i>	5.13- 5.73	5.39- 5.07	5.69- 4.85	5.02- 3.32	5.84- 4.89
	<i>Gap</i>	-.60	.32	.84	1.70	0.95
	<i>T</i>	-5.23	3.32	6.80	7.96	6.50
	<i>Sign.</i>	.000	.001 (.000)	.000	.000	.000
Medium manufacturing (n=96-150)	<i>Means</i>	4.87- 5.19	4.98- 4.54	5.47- 4.36	4.56- 2.90	5.31- 4.33
	<i>Gap</i>	-.33	.43	1.10	1.66	.98
	<i>T</i>	-2.39	4.13	8.93	10.19	7.53
	<i>Sign.</i>	.019 (.001)	.000	.000	.000	.000

Note: the significance shown is at the 0.02-level (2-tailed). Figures within brackets show significance for a one-sided test (1-tailed)

The table shows significance at the 99%-level (1-tailed) supporting the hypothesis. The results show that:

- The hypothesis holds true for four factors (all with the exception of ‘Intra-organizational measures’) since the attributed importance was ranked statistically significantly higher than the possibility for implementation.
- The hypothesis is rejected for the factor ‘Intra-organizational measures’ since the possibility for implementation was ranked higher than the importance. There were small differences, but still significant ones at the 0.025-level, for medium manufacturing and large wholesale companies.
- The smallest, but significant gaps were found in ‘Inter-organizational measures’.
- The largest gaps were found regarding ‘Modal aspects’.

In order to better reflect reality regarding the already implemented measures, it was interesting not only to look at the gaps based on differences in mean values. Those implemented measures can be considered worth more than a ranked 7 for possibility, but it is to simplify by letting these fictive rated 7.001 influence the mean scores. The median better reflects the distribution of scores than the mean values. Therefore a Wilcoxon Signed Ranks method was used where the null hypothesis that two related medians are the same, so that the paired medians between the importance and the possibility for implementation of measures were compared. Instead of comparing means, the Wilcoxon converts scores to ranks and compares them. The differences in the paired observations are calculated, then they are ranked from smallest to largest by absolute value. This is a non-parametric alternative, or distribution free test, to the parametric t-tests. However, these results of the Wilcoxon Signed Ranks test showed that all the hypothesis holds true for the same groups of companies as in the t-tests i.e. they had significant differences between the importance and the possibility of implementation (see Table A6.1 in Appendix 6).

The results of these two analyses show that the transport managers ranked the importance significantly higher than the possibility for implementation in four out of five factors. The opposite holds true for the fifth factor, Intra-organizational aspects, among large manufacturing companies i.e. the importance was ranked lower than possibility for implementation. This negative difference was not significant among large wholesale and medium manufacturing companies. In total, the largest difference was found regarding Modal aspects where the possibility for implementation was far from the importance of these measures. This factor does not have a high priority in comparison to the others but the positive signal to marketers of intermodal transports is that the importance is ranked much higher than the possibility for implementation. The reasons behind this negative judgment of the possibility for implementation must be further looked into e.g. is it based on their own or transport providers contracted past experience or no experience at all, or on the limitations of the freight characteristics? This is an identified knowledge gap and a challenge to marketers of intermodal transports.

## **7.6 Internal and external pressures affecting modal choice**

The survey further aimed at tracking both external environmental demands in the supply chain from customers, as well as internal demands within a company. The choice of transport mode is an example showing to what extent the environment is affected by the shippers' transports where e.g. train is normally regarded as a better alternative to transport than truck. The normal situation is



that the shippers pay and organize the transports. This may differ when the supply chain become more integrated and one example is the automotive industry where the end customer (the car manufacturers) may put demands on suppliers in terms of transports, e.g. according to Just-in-time thinking. Therefore, the mapping of how common it is among customer demands is of high interest. The respondents were asked to answer yes or no to whether their customers had environmental demands that affected their choice of transport mode. Furthermore, the respondents were also asked whether there were any similar demands coming from the own organization (see survey questions 27 and 28 in Appendix 3). The results are seen in Table 7.7.

**Table 7.7 Proportions of respondents receiving environmental demands from customers and own company affecting choice of transport mode, divided on in- and outbound transports**

Stratum	Customers		Own company	
	% Inbound	% Outbound	% Inbound	% Outbound
Small manufacturing	2	7	14	20
Small wholesale	2	7	5	12
Medium manufacturing	14	20	38	45
Medium wholesale	13	16	16	27
Large manufacturing	19	26	50	67
Large wholesale	20	38	35	54
<i>Total, stratified average</i>	6	11	14	22

The internal pressures may for example be manifested through two of the most common devices in environmental management: CEP and EMS (see Section 7.3). It is evident that the internal pressures within a company are much stronger than the pressures from customers. Also, there are more pressures on the outbound transports than the inbound transports, which is not surprising as the companies normally buy the outbound transports themselves and can therefore affect these the most. The share of large manufacturing companies with internal demands on the inbound transports was exceptionally high though (50%). This probably has to do with the more integrated supply chain, where these large companies want to control the whole transport chain, i.e. not only the outbound transports but also the inbound ones, for example in the automotive industry.

The pressures on outbound transports from customers were strongest among the large wholesale companies (38%). Otherwise, the pressures from customers

were quite weak based on the number of companies that received these in the remaining strata (7-26%). However, the internal demands may originate from pressures from customers received by other functions in the company e.g. the marketing department. This is not visible in Table 7.7 though. The companies with large freight volumes (the large companies along with medium manufacturing companies) put internal pressures to the highest extent (54%, 67%, and 45%). This is probably due to the fact that these also have dedicated environmental departments (see Section 7.2 'Implemented measures') that exert pressure on the logistics department. They are more likely to receive more environmental demands from external stakeholders e.g. shareholders and fund investors that scrutinize the disclosure of environmental information in the Corporate Environmental Report, CER. In these reports, at least in Swedish companies, the environmental impact of transports are frequently described, and the choice of transport mode is often emphasized if modes that are better from an environmental point-of-view are used e.g. rail. These companies should be receptive for intermodal road-rail transports. This is an opportunity for the marketing of these transports. These companies may need support in fulfilling their environmental commitments stated in their CER.

## 7.7 Summary

This chapter analyzed how well environmental considerations are integrated into business practice. It also gave a picture of various implemented measures among shippers for reducing the environmental effects of their freight transports, and the shippers' attitudes towards these measures. Also, some internal and external pressures were measured in order to see the drivers of the environmental improvements. In Chapter 6, the total freight volume sent in Sweden was estimated to 119.3 million ton equivalents and 72% was attributable to companies with at least 100 employees (the large companies along with the medium-sized manufacturing companies). The results showed that these groups of companies had implemented environmental measures to the highest extent and also had more pressures for environmental improvements affecting the choice of transport mode, mainly internal ones rather than from customers.

The most commonly implemented measures related to general management tools, were a CEP (30%) and an EMS (21%), and not specific to the transport area. About half of the companies with large transport volumes had also implemented an environmental department or function (45%+48%+64%). There are increased demands in the supply chains on companies today to take environmental considerations into account in their business, and more and more small- and medium-sized manufacturing companies along with large wholesale com-

panies are in the process of implementing a CEP and an EMS. The large manufacturing companies have led the development towards an integration of environmentalism in business practices, and now these practices are spread backwards in the supply chains. CEP and EMS can be considered as internal pressures for environmental improvements of the freight transports. About a quarter of companies in the target population had implemented an EMS, and about the same share was in the process of doing so. It can be concluded that companies with more than 100 employees and representing the largest volume of goods, had either implemented or were in the process of implementing an EMS to the highest extent (77-91%). This is probably because these companies often have dedicated environmental departments, and more resources put into environmental issues. A clear majority of all companies that had implemented one, or was in the process of implementation, had chosen ISO 14001 (92%) where as EMAS had a very small share (6%).

Naturally the decision-makers – the logistics managers – are central in this development. Their attitudes towards different measures for reducing environmental effects of freight transports and their judgments of the possibility of implementation are vital when integrating environmental concerns into business practices. A factor analysis divided 18 measures relating to environmental aspects into 5 factors. Starting with the importance of each factor, the respondents rated factors relating to freight transports particularly the highest ('Outbound transports', 'Load factors' and thirdly 'Inter-organizational measures') the highest. The least importance was attributed to the commonly implemented measures in 'Intra-organizational measures' and 'Modal choice'. The respondents were also most pessimistic about 'Modal choice' when it came to the possibility of implementation and this factor also had the largest gap between the importance and possibility for implementation (where the importance was rated much higher). However, if the total quality of intermodal transports e.g. by road-rail increases, then this will also raise the possibility of implementation. In addition, this will also increase the response for the environmental factor.

This chapter has presented results from the conducted survey showing the degree and desirability of implementation of environmental measures among Swedish shippers, along with the existence of pressures for reducing the environmental effects of freight transports. The next chapter will discuss the environmental considerations in transport buying behavior in relation to the modal choice, and then examine the link between them.



## **8 Perceptions of environmental aspects and intermodal road-rail transports—survey results**

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If the shares of intermodal road-rail transports increased, this would benefit the environment and consequently the society. An opportunity is to emphasize the environmental advantages in the marketing of these transports. This way of using a marketing approach regarding environmental advantages of transport modes has not been applied in literature so far. This chapter looks specifically at whether environmental aspects can be a marketing potential for intermodal road-rail transports. In order to succeed in this, there are mainly three problems that must be analyzed and will thus guide the analysis:

- 1) To establish what weight shippers attribute environmental aspects in comparison to other aspects when freight transports are bought.
- 2) To examine shippers' decisions on modal choice.
- 3) To establish if there is a link between the demand for environmentally preferable transport services, and the modal choice among shippers.

Apart from these, there are two other important issues crucial in marketing that also need to be addressed; customer satisfaction and identification of decision-makers (regarding transport providers and modal choice in this context). After all these issues have been thoroughly analyzed, it is then possible to discuss the marketing potentials for intermodal road-rail transports based on environmental advantage.

## 8.1 Weight of environmental aspects in transport buying behavior

When transports are bought, various aspects of the transport offers are evaluated and among these are the environmental considerations. The survey attempted to measure what weight is attributed to environmental aspects when freight transports are purchased, in combination with other factors such as price and various service factors. Two data analyses were conducted.

The *first analysis* was based on how the respondents' weighted environmental efficiency when selecting transport solution (see Section 6.4). They were asked to distribute 100% among four factors in relation to their importance: price, transport time, on-time delivery and environmental efficiency (see Figure 6.1). A short summary of the results are in place. Price was valued highest of the four factors and its importance decreased with an increased size of the company. The weight attributed to environmental efficiency, represented by carbon dioxide equivalents, was taken into account to a higher degree among those with more than 100 employees; large manufacturing companies stated the highest percentage (10%), followed by large wholesale companies (8%) and medium manufacturing companies (7%). The willingness to pay (the environmental efficiency/price ratio) was also highest in these groups of companies. The other groups of companies with less than 100 employees stated 3% or 5%.

The *second analysis* was made in attempt to weigh the environmental considerations along with other aspects when choosing transport provider. The respondents were asked to attribute weight to each of the 31 listed items when selecting transport provider on a seven-degree semantic differential scale<sup>42</sup> (see survey question 24 in Appendix 3 or 4). The suitability for factor analysis was tested<sup>43</sup> and supported. A Principal component analysis of the transport providers' qualities resulted in a seven factor solution, explaining a total of 55.7% of the variance. The results are seen in Table 8.1. In the factor analysis conducted, the means of the summated scales represented by the seven factors extracted, ranked them in the following order of importance to the shippers: Basic aspects (5.94), Price (5.93), Relational aspects (5.35), Loading/Volume (4.73), Environmental aspects (4.63), IT and additional logistics services (3.96), and Modal aspects (3.27), see Table 8.1. Note that a factor includes items with rotated loadings above 0.4, while a summated scale of a factor signifies the mean value of the items included which load mainly on that factor (see Table 8.1). One of the

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<sup>42</sup> where 1 equaled very low importance and 7 equaled very high importance

<sup>43</sup> The KMO- value was .87 and the Barlett's Test of Sphericity reached statistical significance. The eigenvalues of the components extracted exceeded 1. Catell's scree test was also done.

qualities regarding geographic coverage (“covers our market geographically in a sufficient manner”) did not load over 0.4 of any of the factors<sup>44</sup> and was therefore not included in any of the summated scales. After this, Factor 7 contained only one quality (“offers one of the lowest prices”) and therefore Factor 7 represents a single item instead of a summated scale in the following analysis. The items ‘Price’ and ‘Geographic coverage’ are included as single items for reasons of comparison.

The analysis shows that ‘Basic aspects’ were ranked the highest (where item means showed that “keep to time agreed upon” and “fulfills its commitments” were at the top according to Table 6.9), but ‘Price’ were also highly required by the shippers. This can be compared to the result in the first analysis (see Figure 6.1) that showed that price was at the top and on-time delivery was never attributed more than 28% of the importance when selecting transport solution. ‘Relational aspects’ were important, even more important than ‘Loading/volume’. Not far behind, the factor ‘Environmental aspects’ was attributed considerable importance and was ranked higher than both ‘IT and additional logistics services’ and ‘Modal aspects’. IT and 3<sup>rd</sup>-part logistics are hot topics for the transport providers, but the results show that the demand for these services are not yet high from the shippers. The factor Modal aspects was ranked the lowest of all factors. However, ‘Environmental aspects’ had a higher priority which indicates that emphasizing potential environmental aspects may help in raising the interest and priority of modal aspects, and thus intermodal road-rail transports.

Many of the environmental aspects of transportation were included in the factor ‘Environmental aspects’. The item “has a quality certification e.g. ISO 9000” also fell into this factor and a possible explanation might be that the respondents cannot distinguish it from ISO 14001 (a separate item). However, there are three items that contribute to the environmental impact of the transports, but were included in the factor ‘Loading/Volume’ instead: “offers coordinated shared deliveries with other companies in order to reduce empty load transports”, “can coordinate our inbound and outbound transports”, and “has a high loading factor of goods”. This last item also loaded above 0.3 on ‘Environmental aspects’ and ‘Modal aspects’ (but are not included in Table 8.1) and thus indicating a connection between these three aspects in the minds of the shippers<sup>45</sup>.

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<sup>44</sup>The highest loadings received were 0.39 on Factor 7 and 0.35 on Factor 3.

<sup>45</sup> The loadings were; .39 on Factor 2 and .31 on Factor 4.

**Table 8.1 Structure matrix of Principal component analysis with Varimax-rotated factor loadings of importance when selecting transport provider**

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
	Basic aspects	Environmental aspects	IT & additional logistics services	Modal aspects	Relational aspects	Loading/Volume	Price
<b>“The transport provider...”</b>							
..keep to time agreed upon	0.78						
..fulfills its commitments	0.76						
..is easily accessible regarding inquiries & bookings	0.72						
..is easily accessible regarding follow-up	0.65						
..has consistent quality	0.60						
..has well functioning routines for reporting deviations	0.59						
..knows how to handle our freight in order to avoid damages	0.51						
..can offer custom-made transport solutions	0.51						
..can make deliveries at short notice	0.50						
..has safety routines against theft and loss	0.44						
..has good routines for handling documents	0.43						
..has environmentally efficient transports		0.85					
..is certified by an environmental management system e.g. ISO 14001		0.84					
..uses trucks in high environmental classes		0.81					
..has a quality certification e.g. ISO 9000		0.65					
..uses other fuels than diesel, e.g. bio-fuel and gas		0.62					
..has a good IT support system for following the freight (e.g. track and trace)			0.78				
..has a good IT support system for receiving our orders (e.g. EDI, Internet)			0.72				
..has a wide range of complementary logistics services			0.50				



<b>Items</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>	<b>Factor 5</b>	<b>Factor 6</b>	<b>Factor 7</b>
	<i>Basic aspects</i>	<i>Environ- mental aspects</i>	<i>IT and comple- mentary logistics services</i>	<i>Modal aspects</i>	<i>Rela- tional aspects</i>	<i>Load- ing/Volu- me</i>	<i>Price</i>
..can offer intermodal truck-train transports				0.81			
..can offer freight transports on rail				0.78			
..gives us access to detachable load-carriers (e.g. swap-bodies, semi-trailers)				0.56			
..can offer transport modes we desire (truck, train, boat, flights or combined)				0.45			
..has a good reputation					0.79		
..has been engaged by us previously					0.72		
..meets with kind treatment at collection and delivery of freight	0.45				0.53		
..offers coordinated shared deliveries with other companies in order to reduce empty load transports						0.64	
..has a high loading factor of freight						0.55	
..can adjust to large variations in volumes						0.51	
..can coordinate our inbound and outbound transports			0.42			0.50	
..has many scheduled departures						0.40	
..offers one of the lowest prices							0.76
<i>Eigenvalue</i>	7.73	3.05	2.07	1.84	1.45	1.19	1.06
<i>% of variance explained</i>	14.17	10.82	8.05	6.94	6.05	5.89	3.71
<i>Mean Summated Scale</i>	5.94	4.63	3.96	3.27	5.35	4.73	(5.93)

Note: The factor loadings less than 0.4 are not shown.

The strata means were extracted in order to see the differences in importance between the strata, see Table 8.2. Also, two single items were included along with the summated scales: ‘Price’ and ‘Geographic coverage’, since they are important to the shippers. They constituted Factor 7 ‘Price’ in the factor analysis but is now broken apart into single items instead, since the reliability coefficient by Cronbach’s alpha was very low (see Table 4.6). ‘Price’ had an average of 5.67 and ‘Geographic coverage’ of 6.19 in the survey sample.

**Table 8.2 Means based on rated importance of the six factors (summated scales) and two single items**

Stratum	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Item Price	Item Geogr. Cover.
Small manufacturing	5.68	4.00	3.77	3.02	5.32	4.30	5.73	6.04
Small wholesale	5.84	3.95	4.04	2.60	5.36	4.28	5.60	6.44
Medium manufacturing	5.89	4.52	3.89	3.20	5.21	4.79	5.76	6.00
Medium wholesale	6.04	4.32	4.13	3.19	5.44	4.70	5.75	6.36
Large manufacturing	6.13	5.20	4.08	3.93	5.30	5.11	5.69	6.21
Large wholesale	5.96	4.90	3.96	2.91	5.50	4.62	5.41	6.39

A comment about the single items ‘Geographic coverage’ and ‘Price’, which were included in Factor 7 in the factor analysis (even though Geographic coverage loaded less than 0.4), is in place. It is evident that ‘Geographic coverage’ was rated much higher in importance among the wholesale companies, regardless size, than among the manufacturing companies. ‘Price’ showed a more diversified picture. It was highly valued by all but especially by the small and medium manufacturing companies and medium manufacturing companies.

Factor 2 ‘Environmental aspects’ scored highest among large manufacturing companies (5.20), large wholesale companies (4.90) and medium manufacturing companies (4.52). These were the same groups of companies that rated environmental aspects the highest in the earlier analysis of the trade-off question with price, transport time and on-time delivery (see Section 6.4).

In sum, these initial analyses prove that the company groups that value environmental aspects in freight transports buying highest are companies with at least 100 employees (the large companies along with the middle-sized manufacturing companies). These companies account for 72% of the freight volume in ton equivalent weight sent in the target population in Sweden. Therefore, a filter will be introduced from now on in choosing what respondents to include. As a

consequence, further analyses in this chapter will mainly be based on these three strata, and exclude companies with less than 100 employees.

The two initial analyses differed between each other regarding how environmental aspects were measured. The first analysis (where the respondent distributed 100%) concerned importance of environmental aspects when selecting transport solution, whereas Factor 2 Environmental aspects from the factor analysis was based on importance when selecting transport provider to the shipper. Thus, these two analyses did not measure exactly the same, but they should however be correlated. For validation purposes, Pearson tests of correlation were performed between these two variables representing environmental aspects in the three strata with more than 100 employees, see Table 8.3. This supports the convergent validity of the scales.

**Table 8.3 Correlation coefficients (Pearson tests) between two environmental aspects variables; the choice of transport solution and of transport provider**

Environmental aspects		Choice of transport provider		
		Medium manufacturing	Large manufacturing	Large wholesale
Choice of transport solution	<i>Correlation coefficient</i>	.531**	.346**	.221*
	<i>Sig. (2-tailed)</i>	.000	.000	.041
	<i>n</i>	160	116	86

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

As expected, correlation was high between the two variables representing environmental aspects when transport solution and transport provider respectively is chosen. It was a highly significant positive correlation among the manufacturing companies ( $p=0.001$ ) and a more moderate significant correlation among the large wholesale companies ( $p=0.005$ ).<sup>46</sup>

The findings relating to the first problem of this chapter “to establish what weight shippers attribute environmental aspects in comparison to other aspects when freight transports are bought” may at this stage be summarized. The shippers valued price highest of the four factors measured (price, transport time, on-time delivery and environmental efficiency) when transport solution was chosen. The weight attributed to environmental efficiency, represented by carbon dioxide equivalents, was taken into account to a higher degree among those

<sup>46</sup> The coefficient of determination shows the variance shared to: 28.2% (medium manufacturing companies), 12.0% (large manufacturing companies), and 4.9% (large wholesale companies).

with more than 100 employees, with shares of 7-10% per group where large manufacturing companies stated the highest percentage (10%). The groups of companies with less than 100 employees stated either 3% or 5%. Regarding the importance of environmental aspects when transport provider chosen, the summated scale of the factor 'Environmental aspects' was ranked fifth of the seven factors, before both 'IT and additional logistics services' and 'Modal aspects'. The same strata as in the analysis when transport solution was chosen received the highest mean on 'Environmental aspects' and they account for 72% of the freight volume in ton equivalent weight sent by companies with freight transports exceeding 150 km.

## 8.2 Satisfaction with transport providers

The next step is to examine how satisfied the freight transport customers, the shippers, are with their current transport providers especially focusing on environmental aspects and modal choice. In Section 8.1, six of the factors extracted from the factor analysis were ranked as summated scales in order of importance to all shippers, regardless size: 'Basic aspects' (5.94), 'Relational aspects' (5.35), 'Loading/Volume' (4.73), 'Environmental aspects' (4.63), 'IT and additional logistics services' (3.96), and 'Modal aspects' (3.27). In addition, there were two single items important to the shippers: 'Price' (5.67) and 'Geographic coverage' (6.19). Moreover, the respondents were asked to indicate to what degree their current transport provider(s) had each of the characteristics as expressed by the 31 items used in the factor analysis, using the same seven-degree semantic differential scale (see survey question 24 in Appendix 3 or 4). The potential gaps between the importance (to what degree the item is desired) and the actual performance/outcome today (to what extent the current transport fulfill this characteristic), represents the level of satisfaction. It is the gap that is interesting in this analysis, not the absolute weight indicated as in the summated scales.

If the competition of the market for transport services functions well, there should be an equilibrium between the importance attributed and the actual performance today. The hypothesis is that these two match and there should be no significant difference between the attributed weights. In order to identify these potential gaps, paired t-tests of the seven factors (based on summated scales) and the additional two single items 'Price' and 'Geographic coverage', were conducted among the companies with more than 100 employees. The total blank cases of the non-responses were deleted (34 cases of 567; n=533). Then these tests were conducted by replacing the partly missing values by strata means i.e. the number of missing values varied between the different summated

scales; ranging from 12 to 113 cases (from 2% to 21% of the total 533 cases)<sup>47</sup>. Secondly, the tests were also run without these imputations and thus a higher non-response, but it showed the same significance levels. The results are displayed in Table 8.4.

**Table 8.4 Paired samples t-test in strata, between importance attributed to each factor and to what degree currently used transport providers comply**

Factors/ Items	Large wholesale (df=87)				Large manufacturing (df=121)				Medium manufacturing (df=170)			
	Mean	Gap mean	T	Sig	Mean	Gap mean	T	Sig	Mean	Gap mean	T	Sig
<b>Factor 1:</b> Basic Aspects	5.93- 5.15	.785	9.33	<b>.000</b>	6.14- 5.50	.63	10.63	<b>.000</b>	5.90- 5.45	.441	8.21	<b>.000</b>
<b>Factor 2:</b> Environ- mental as- pects	4.87- 4.94	-.077	-.61	.544	5.22- 5.23	-.01	-.08	.938	4.51- 4.92	-.403	-4.20	<b>.000</b>
<b>Factor 3:</b> IT & additional logistics services	3.93- 4.23	-.293	-2.38	<b>.019</b>	4.07- 4.46	-.39	-4.09	<b>.000</b>	3.89- 4.55	-.664	-6.53	<b>.000</b>
<b>Factor 4:</b> Modal as- pects	2.94- 3.37	-.425	-3.11	<b>.003</b>	3.93- 4.43	-.50	-4.60	<b>.000</b>	3.24- 4.21	-.974	- 10.35	<b>.000</b>
<b>Factor 5:</b> Relational aspects	5.50- 5.54	-.042	-.45	.653	5.33- 5.67	-.33	-4.03	<b>.000</b>	5.25- 5.64	-.390	-4.63	<b>.000</b>
<b>Factor 6:</b> Loading/ Volume	4.59- 4.66	-.068	-.64	.523	5.12- 5.12	-.00	-.06	.956	4.77- 5.02	-.249	-3.26	<b>.001</b>
<b>Factor 7:</b> Price	5.90- 5.50	.397	4.67	<b>.000</b>	5.95- 5.73	.22	3.87	<b>.000</b>	5.88- 5.75	.132	2.30	<b>.022</b>
<b>Item Price</b>	5.41- 5.11	.302	2.35	<b>.000</b>	5.69- 5.26	.43	4.85	<b>.000</b>	5.76- 5.50	.259	2.91	<b>.004</b>
<b>Item Geo- graphic coverage</b>	6.39- 5.90	.492	4.45	<b>.000</b>	6.20- 6.19	.01	.19	<b>.000</b>	6.00- 6.00	.006	.08	.937

Note: Values in bold are significant at the at the 0.05-level or lower (2-tailed)

If the gaps show a significant difference, either positive or negative, the hypothesis stated does not hold true. The gaps can show three outcomes: a significant positive difference, a significant negative difference and no significant difference. A significant, positive difference indicates that the currently used transport providers perform worse on the characteristics of a factor than the

<sup>47</sup> The missing cases were: Scale 1=96, Scale 2=106, Scale 3=62, Scale 4=113, Scale 5=53, Scale 6=101, Scale 7=29 and Item Price=43 and Item Geographic coverage=40.

shippers wish. This was the case for the factors 'Basic aspects' and 'Price' for all companies. Neither the item 'Geographic coverage' satisfied the groups with large companies, which may be due to their large share of long-distance transports, including exports, and thus cover a large geographic area. On the other hand, a significant negative difference indicates that they perform better than the shippers require. These results were obtained regarding the factors 'IT and additional services logistics' and 'Modal aspects' for all companies, but also Relational aspects among the manufacturing companies. This was also the case among medium-sized manufacturing companies regarding 'Loading/Volume' and 'Environmental aspects'.

The hypothesis formulated holds true when there are no statistically significant differences between the two ratings, and thus indicating content shippers as the expected and delivered service characteristics of a factor match. This was shown in certain strata of three of the factors and one item: 'Loading/Volume' and 'Environmental aspects' for the large companies, along with 'Relational aspects' among the large wholesale companies and 'Geographic coverage' among medium manufacturing ones. The shippers were thus satisfied.

The factors that were rated highest in importance by the shippers, represented by the means of summated scales, were 'Basic aspects' and 'Price'. However, the transport providers did not fulfill these requirements as much as they were demanded. 'Basic aspects' clearly showed the largest difference in means among the large companies; especially among the wholesale companies and somewhat narrower among the manufacturing ones. It was statistically significant gaps regarding the item 'Price' for all companies but especially among the large manufacturing companies. All three groups of companies believed they paid a too high price for their transport services. This is probably a common perception for a Logistics manager in charge of purchasing of transport services; it would rather be surprising if the shippers thought they paid a too low price. It is their task to minimize the prices paid for these services under the circumstance that the perceived value is satisfactory.

Two of the factors are especially interesting for the purpose of this chapter: 'Environmental aspects' and 'Modal aspects'. The importance of the characteristics represented by the factor 'Environmental aspects' is in level with what the current transport provider offers among the large companies. This means that the hypothesis holds true and the shippers are content with the current performance. However, the results showed a significant negative difference among the medium manufacturing companies, which indicates that the transport providers perform better than these shippers require. One possible explanation is that the

transport providers are offering these shippers a good service, or another explanation is that the shippers' demands are at a low level due to e.g. lack of knowledge in environmental issues. The factor 'Modal aspects' gave the same result among all three groups of companies: a significant negative difference showing that the transport providers perform better than these shippers require. Among the medium manufacturing companies, this gap was the largest (positive or negative) one in terms of difference in mean of all 21 gaps i.e. the transport providers fulfill the demands with most marginal and more than is required from customers. The gaps identify how each respondent has assigned weight of a factor when choosing transport provider, and to what degree the current transport provider fulfill this factor. However, these gaps do not show on what level factors are rated by the buyers but the means of summated scales do, also shown in Table 8.4 divided per stratum. All companies in the three strata in the table showed higher means in importance regarding 'Environmental aspects' and 'Modal aspect's, than those summated means in the factor analysis based on all sizes of companies in Table 8.1.

The findings about the satisfaction with transport providers among companies with more than 100 employees, relate to two of the problems formulated in the introduction of this chapter. The first one is "to establish what weight shippers attribute environmental aspects in comparison to other aspects when freight transports are bought". The two strata with the large manufacturing and wholesale companies rate the factor 'Environmental aspects' the highest in importance of all groups of companies (5.22 and 4.87 respectively). The paired t-tests of this factor showed that there was not a significant difference between what the shippers in the large companies demanded and what the transport providers offered. This was not the case among the medium manufacturing companies though since the transport provider performed better than demanded, according to these shippers. The second problem of this chapter is "to examine shippers' decisions on modal choice" and it was the medium and large manufacturing companies that mainly ranked the factor 'Modal aspects' the highest of all companies in importance (3.2 and 3.9 respectively). The large wholesale companies did not rate this factor as high (2.9) and the paired t-tests of the factor in this stratum showed the largest gap of all 21 gaps. The t-tests in all three strata showed the same result: the transport providers perform better than the shippers require i.e. they offer various modes of transport.

### 8.3 Decision-makers of transport provider and modal choice

In a marketing setting, it is crucial to identify the decision-makers among the shippers i.e. in what function the responsible for choosing transport provider is found, see Table 8.5. Note that more than one alternative was possible to choose for a respondent (see survey question 6 in Appendix 3).

**Table 8.5 Proportion of decision-makers of the choice of transport provider(s) in various positions**

<b>Stratum</b>	<b>Logistics Manager</b>	<b>Senior Management, Company</b>	<b>Purchasing Manager</b>	<b>Customer</b>	<b>Senior Management, Local unit</b>	<b>Other</b>
	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Medium manufacturing	47.4	19.4	24.0	16.0	9.7	6.3
Large manufacturing	73.6	7.8	14.7	10.1	6.2	14.7
Large wholesale	61.5	18.7	6.6	6.6	18.7	0.4

The most common position for the persons at the companies making the decision of which transport providers to choose, is as Logistics Manager. The share was higher among the large companies, probably due to the fact that it is more common with a dedicated logistics function normally headed by a Logistics Manager. In the medium manufacturing companies, the decision lies within the domain of a Purchasing Manager (24%) and it is also in this group of companies where it is more frequent that the customers participate in the decision (16%). The Senior Management of the companies is involved in this decision in about 19% of the companies among the medium manufacturing companies and in the large wholesale companies.

The next interesting question is who is actually making the decision about modal choice (see survey question 7 in Appendix 3).. A division on different groups was made and it was possible to choose more than one alternative, see Table 8.6.



**Table 8.6 Proportion of decision-makers of the choice of transport mode(s) in various positions**

<b>Stratum</b>	<b>Logistics Manager</b>	<b>Senior Management Company</b>	<b>Purchasing Manager</b>	<b>Customer</b>	<b>Senior Management Local unit</b>	<b>Other</b>	<b>Our transport provider</b>
	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Medium manufacturing	47.5	12.3	21.2	35.2	9.5	7.8	7.3
Large manufacturing	76.6	4.7	8.6	23.4	5.5	10.9	5.5
Large wholesale	58.9	8.9	3.3	11.1	16.7	2.3	7.8

The first to note is that the shares of logistics managers making decisions about modal choice are similar to shares of logistic managers choosing transport providers. The same is valid regarding the group of decision-makers from Senior Management of the local unit. A striking difference is the frequency of customers as decision-makers as this group has more influence on the choice of transport mode than of transport provider: in size equal to a doubled share. The customers are involved in the choice of transport mode in 35.2% of medium manufacturing companies and one possible explanation is the effect of Just-in-time philosophy, where large customers control the transports from their suppliers. The customers did not play as an important role among the large wholesale companies (in 11% of the companies). The transport providers had a minor role in the choice of transport mode, according to the customers (5.5-7.8%). This figure may not necessarily show the true share though, as transport providers sometimes do not inform their customers of transport modes used.

The findings of the decision-makers of transport providers and modal choice, relates mainly to the second problem of this chapter “to examine shippers’ decisions on modal choice”, but to some extent also to the first one. The most common position for the persons making the decision of which transport providers to choose or modal choice, is as Logistics Managers. Customers have more influence on the choice of transport mode than of transport provider. The customers are involved in the choice of transport mode in more than 1/3 of medium manufacturing companies but did not play as an important role among the large wholesale companies, about 1/10. The transport providers had a minor role in the choice of transport mode, according to the shippers (about 6-8%). The identification of decision-makers is useful knowledge in reaching target groups and can e.g. be used in marketing communication of environmentally preferable transport services.

## 8.4 Environmental demands affecting the decision on transport mode

The decision on what transport mode to use for the outbound transports can be influenced by environmental demands from different stakeholders groups. The normal situation is that the shippers pay and organize the transports. This may differ some when the supply chain becomes more integrated and one example is in the automotive industry where the end customer (the car manufacturers) may put demands on suppliers, e.g. according to Just-in-time thinking. Therefore, the mapping of how common customer demands are is of high interest. The respondents were asked to simply answer yes or no to whether their customers had environmental demands that affect the mode of transport used. Further the respondents were also asked whether there were any environmental demands from their own company. A first analysis was based on strata for each source of pressures separately (see Table 7.7 for results and survey questions 27 and 28 in Appendix 3). In the intermodal context, it is however interesting also to analyze the relationships between the two sources of demands put on the companies with large freight volumes, see Table 8.7.

**Table 8.7 Relationship between demands from customers and own company regarding outbound transports**

Sources of pressure			From customers, %		
			Yes	No	Total
Medium manufacturing (n=148)	Yes		18.2	26.4	44.6
	No		2.7	52.7	55.4
	Total		20.9	79.1	100
From own company, %	Large manufacturing (n=102)	Yes	24.5	40.2	64.7
		No	1.0	34.3	35.3
		Total	25.5	74.5	100
	Large wholesale (n=75)	Yes	25.3	28.0	53.3
		No	13.3	33.3	46.7
		Total	38.7	61.3	100

*Note:* Based on raw frequencies

The large companies received pressures from both customers and their own company to the highest extent (about 25%), which can be compared to 18.2% among the medium manufacturing companies. The latter had also the largest share among all groups of companies that did not receive any demands at all from customers (79.1%), or from their own company (55.4%), or when de-

mands from both customers and their own company were included (52.7%, compared to 33.3% and 34.3% respectively among the large ones). It was especially the large manufacturing companies that received pressures from their own company (64.7%), even when there were no pressure from customers (40.2%, compared to 26.4% and 28.0% in the other two groups). The group of companies that received most pressure from customers was the large wholesale companies (38.7%, compared to manufacturing ones with 20.9% and 25.5%).

Chi-square tests for independence were used and the variables were found to be dependent at the 99%-level-. The proportion of those manufacturing companies receiving environmental demands from both customers and their own company, is significantly different from the proportion of those receiving demands only from their own company but not from customers<sup>48</sup>. It was not a significant difference among large wholesale companies. The strength of the relationships between the demands on the outbound transports from customers and from the own company was investigated using Phi measure of association. There was a significant positive correlation between the two variables among the medium and large manufacturing companies [ $r=.44/.39$ ,  $n=148/102$ ,  $p<.0005$ ], but a non-significant small, positive correlation among the large wholesale companies [ $r=.194$ ,  $n=75$ ,  $p=.093$ ]<sup>49</sup>. This means that if the manufacturing companies receive more pressure from customers, then the pressure from the own company increases as well.

The findings of the environmental demands affecting the choice of transport mode, relates to the second problem of this chapter “to examine shippers’ decisions on modal choice”. The large companies received pressures from both customers and their own company to the highest extent (about 25%). It was especially the large manufacturing companies that received pressures from their own company (about 65%), even when there was no pressure from customers. The group of companies that received most pressure from customers was the large wholesale companies (about 39%). There was a significant positive correlation between the demands on the outbound transports from customers and from the own company among the manufacturing companies, but a non-significant small, positive correlation among the large wholesale companies.

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<sup>48</sup> The corrected values for manufacturing companies are: 26.5 (medium-sized) and 13.3 (large-sized) with a significant level of  $<.0005$ . For large wholesale companies, it is 2.1 with an associated significant level of .15.

<sup>49</sup> The coefficients of determination show the shared variance to 19.4% (medium manufacturing), 14.8% (large manufacturing), and 3.8% (large wholesale).

## 8.5 Connection between environmental aspects and modal choice

When discussing environmentally preferable transport services, the modal choice is of importance. The factor ‘Modal aspects’ shows how the shippers appreciate the possibility of using other modes of transports than the dominating mode of transport today, truck. The three items that received the highest loadings on this factor in the factor analysis were: “can offer combined transports truck-rail”, “can offer freight transports on rail”, and “gives us access to detachable load-carriers. A hypothesis is that shippers who evaluate ‘Modal aspects’ highly also appreciate environmentally preferable transport services. In order to test this, a correlation analysis was made between the factors extracted in the factor analysis for companies with more than 100 employees, see Table 8.8.

**Table 8.8 Correlation between factors among companies with more than 100 employees**

Factors (summed scales)	1	2	3	4	5	6
1 Basic aspects						
2 Environmental aspects	.43**					
3 IT and additional logistics services	.33**	.29**				
4 Modal aspects	.27**	.42**	.33**			
5 Relational aspects	.48**	.39**	.19**	.25**		
6 Loading/Volume	.48**	.47**	.37**	.43**	.31**	
7 Price	.18**	.00	.13*	.08	.02	.15**

\* Correlation is significant at the 0.02 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

‘Environmental aspects’ correlated most strongly with the factors ‘Loading/Volume’ and ‘Basic aspects.’ ‘Loading/Volume’ includes items that affect the environmental performance of the transports (as discussed in Section 8.1). It was almost as strong, positive correlation between ‘Environmental aspects’ and ‘Modal aspects’ [ $r=.42$ ,  $n=338$ ,  $p<.0005$ ]. The strength of the correlation can be regarded as quite strong. In order to validate this correlation, it was also tested on the total sample, with companies of all sizes. It resulted in a significant correlation and almost as strong as among the companies with more than 100 employees [ $r=.39$ ,  $n=464$ ,  $p<.0005$ ]. The high correlation between the factors Modal aspects and Environmental aspects is also an indication of convergent validity. This connection was also indicated in the importance attributed to one item in the factor analysis in Section 8.1 (“The transport provider has a high loading factor of goods”), which loaded not only on ‘Loading/Volume’ but also on ‘Environmental aspects’ and ‘Modal aspects’ (see Section 8.1).

The findings relating to the third problem of this chapter “to establish if there is a link between the demand for environmentally preferable transport services and the modal choice among shippers” may be summarized. The positive, significant correlation between Environmental aspects and Modal aspects confirmed the hypothesis that shippers who evaluate ‘Modal aspects’ highly also appreciate environmentally preferable transport services. The correlation was somewhat stronger among companies with more than 100 employees. This knowledge is important information for marketers of transport modes that are better from an environmental point-of-view, in the way they form their marketing arguments and how it is used in the marketing communication.

## 8.6 Summary

This chapter focused on the shippers’ environmental requirements on transport services bought, applied on the intermodal road-rail case. It was expressed in three main problems. The first problem of this chapter was “to establish what weight shippers’ attribute environmental aspects in comparison to other aspects when freight transports are bought”. The initial empirical results of this problem showed two things. Firstly, the analysis focused on four factors when the shippers select transport solution (price, transport time, on-time delivery and environmental efficiency) and price was valued the highest. The weight attributed to environmental efficiency, represented by carbon dioxide equivalents, was taken into account to a higher degree among those with more than 100 employees, with shares of 7-10% per group, where large manufacturing companies stated the highest percentage. The groups of companies with less than 100 employees stated either 3% or 5%. Secondly, the importance of various characteristics of the transport providers when shippers choose transport provider was in focus and a Principal components analysis with Varimax rotation extracted seven factors. The summated scale of the factor ‘Environmental aspects’ was ranked fifth of the seven factors, before both ‘IT and additional logistics services’ and ‘Modal aspects’. The same three strata as in the analysis when transport solution was chosen received the highest mean on ‘Environmental aspects’. The results of these two analyses together with the fact that companies with more than 100 employees were responsible for 72% of the freight sent in ton equivalents in the target group, led to a filtering of respondents. In the subsequent analyses, companies with less than 100 employees were excluded.

The next step was to scrutinize how content these shippers are today with current transport providers regarding a number of areas, represented by the factors extracted. A first general conclusion is that the transport providers performed

worse than what the respondents valued regarding the factors 'Basic aspects' and 'Price' i.e. the two factors that were valued the highest in importance in all strata. The most relevant findings about the satisfaction with transport providers relate to the first two problems of this chapter. The first one was: "to establish what weight shippers' attribute environmental aspects in comparison to other aspects when freight transports are bought". The factor 'Environmental aspects' was rated highest in importance of all strata, among the large manufacturing and wholesale companies (5.2 and 4.9 respectively). The paired t-tests of this factor showed that there was not a significant difference between what the shippers in the large companies demanded and what the transport providers offered i.e. the transport providers are in level with what shippers demand. This was also true regarding 'Loading/Volume' (that influences the environmental performance of the transport as well). This was not the case among the medium manufacturing companies though, since the transport providers performed better than demanded, according to these shippers.

The level of satisfaction with transport providers also relates to the second problem of this chapter: "to examine shippers' decisions on modal choice". The factor 'Modal aspects' was valued the lowest of the seven factors among all companies. It was the medium and large manufacturing companies that mainly valued it highest of all companies (3.2 and 3.9 respectively). The large wholesale companies did not rate this factor as high (2.9) and the paired t-test of the factor in this stratum showed the largest gap of all 21 gaps relating to satisfaction with transport providers. The t-tests in all three strata showed the same result: the transport providers perform better than the shippers require i.e. they offer various modes of transport, but the demand from customers for these alternatives is lower.

An important component in the marketing of transport services is the identification of the decision-makers of transports among shippers. The decision-makers of transport providers and modal choice, relate mainly to the second problem of this chapter "to examine shippers' decisions on modal choice", but to some extent also to the first one. The results showed that the choice of transport provider(s) was mainly made by the Logistics managers. The selection of transport mode was also made by the logistics managers, but to a quite high extent also by the customers, especially among the medium manufacturing companies (35%). Customers have more influence on the choice of transport mode than the transport provider. The customers are involved in the choice of transport mode in more than 1/3 of medium manufacturing companies but did not play as an important role among the large wholesale companies, about 1/10. The transport providers had a minor role in the choice of transport mode (6-8% in the three strata), according to the shippers.

The influence processes taking place among the decision-makers at the shippers may originate from various stakeholders. However, pressures in the form of environmental demands from within the company and customers may directly affect the decisions on transport mode and therefore relate to the second problem of this chapter “to examine shippers’ decisions on modal choice”. The large companies received pressures from both customers and their own company to the highest extent (about 25%). It was especially the large manufacturing companies that received pressures from within their own company (about 65%), even when there was no pressure from customers. The group of companies that received most pressure from customers was the large wholesale companies (about 39%). There was a significant positive correlation between the demands on the outbound transports from customers and from within the company among the manufacturing companies, but a non-significant small, positive correlation among the large wholesale companies.

If environmental arguments are to be used in the marketing communication of intermodal road-rail freight transports, it is important to know whether the buyers of transport services make the association between environmental aspects of transportation and those of modal choice. The findings relating to the third problem of this chapter “to establish if there is a link between the demand for environmentally preferable transport services and the modal choice among shippers” is then vital. The positive, significant correlation between ‘Environmental aspects’ and ‘Modal aspects’ confirmed the hypothesis that shippers who value ‘Modal aspects’ highly also appreciate environmentally preferable transport services. The correlation was somewhat stronger among companies with more than 100 employees. This knowledge is important information for marketers of intermodal road-rail transport– in the way they form their marketing arguments based on environmental advantage and how it is used in the marketing communication.

This chapter mainly tackled three problems relating to the shippers; the weight of environmental aspects in transport buying behavior, the decision of modal choice and finally, the link between the two. As shown, these results have implications for marketing of intermodal road-rail transports based on environmental advantage. This will be discussed more in the next chapter which will wrap up the findings from the empirical studies in this thesis.



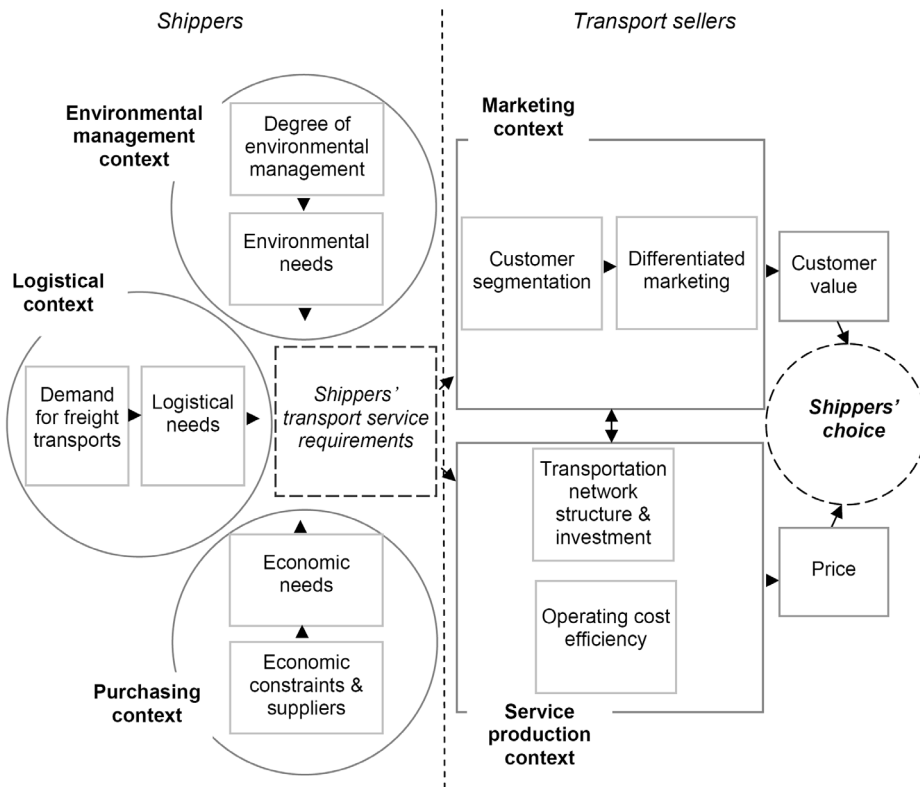


## PART 3: CONCLUDING DISCUSSION

### 9 Conclusions

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Starting in theory, the four theory fields relevant to this thesis are marketing, logistics, purchasing and environmental management. This theoretical knowledge can be applied in practice e.g. to make valid market management analyses that can be used in developing marketing programs of transport services based on emphasizing the environmental aspects. The theory findings were shown in a conceptual framework for marketing of freight transports based on environmental advantage and resulted in a proposed process-focused model (see Figure 2.4). It can be used as a tool in analyzing how to create customer value for freight transport buyers by taking their need for transports and their environmental management commitment into consideration along with the economic constraints and integrate it in the *Marketing context* of transport sellers. All this is possible by scrutinizing the shippers' transport service requirements. This process is seen in Figure 9.1 (which is identical to Figure 2.4). However, the role of price is an important component. It originates from the transport sellers' *Service production context* that must be considered in relation to the customer value. In the end, it is ultimately the shippers' choice. This conceptual model will form the foundation of this chapter with conclusions that will wrap up the empirical findings in this thesis. It is applied on the marketing of intermodal road-rail transports by emphasizing the environmental advantages.



**Figure 9.1 The use of theory in marketing, logistics, purchasing and environmental management for the marketing of environmental advantages in freight transportation**

The strategic market management framework of Aaker was discussed in Section 2.2. It was also used in order to position this thesis (in Section 3.2) and it was established that the scope lies mainly within the external analysis in a marketing context. It was firstly concluded that basic data were needed about the shippers, which forms the demand basis. Secondly, information was needed about how the customers of transport services value and work with environmental aspects especially in combination with transport purchasing. The results presented here contribute mostly to the customer and market analysis included in the external analysis. Therefore, the conclusions presented below in the transport sellers sphere are mainly within the marketing context, rather than within the service production context.

The focus of the model is the *Shippers' transport service requirements*. This forms the foundation on which the shippers make their purchasing decisions –

the actual outcome of the logistical decision-making process. These requirements are formed in the *Logistical context* based on their logistical needs, and also in the *Environmental management context* resulting in to what degree environmental considerations are taken into account. The environmental needs reflect to what degree the shippers have implemented environmental management in their companies and therefore also the indicated importance of environmental aspects in a purchasing situation of their freight transports. Naturally, the *Purchasing context* has an influence as well which puts economic constraints on the transport services to be bought. The transport sellers incorporate shippers' transport service requirements in a marketing context that will form their marketing strategies on the market. Before focusing further on shippers' requirements, it is useful to summarize the findings from the logistical, environmental management and purchasing context.

## 9.1 Logistical context

The logistical context includes the basic data about the Swedish shippers, which form the **demand for freight transports**. In this thesis, this was mainly collected through the conducted survey, which was based on a stratified random sample of 1,154 active companies in the target population i.e. having transports exceeding 150 km. The sample sizes were arrived at through double sampling and the six strata used were based on number of employees and trade of business (manufacturing and wholesale companies). It must be emphasized that the design with the telephone-initiated survey method applied, signified that far-reaching efforts were made; all in order to establish if the company was in the target population, to identify the right respondent and to minimize the non-responses (see Chapter 4). The survey results showed some relevant facts of the transport patterns (see Chapter 6) for the further discussion of intermodal road-rail transports. They related to mainly four interesting aspects.

*Firstly*, an important consideration is the volume of freight sent by the shippers. The sample total of the survey is equal to 40.8 million ton equivalents of freight and the estimated total freight sent in Sweden is then approximately 119 million ton equivalents. About 3/4 of the tonnage was attributable to local units with at least 100 employees and all manufacturing companies together accounted for a similar share (see Table 6.1).

*Secondly*, the length of the freight flows is interesting. In the survey, the respondents were asked to state the share of the freight volumes to domestic destinations in four categories of distances: 0-150 km, 150-300 km, 300-600 km and 600 km or more. Most long-distance freight volumes (600 km or more) are

sent by large and medium manufacturing companies. The beneficial environmental effects of intermodal road-rail transports increase with the transport distance. As a rule of thumb, it can be assumed that the distance of transportation should surplus about 300 km to be considered superior from an environmental point-of-view in comparison to a road transport. The shares of freight sent longer than 300 km domestically within each stratum are highest (>40%) among large manufacturing companies, medium manufacturing companies, and medium wholesale companies (see Table 6.4).

*Thirdly*, the division on destination of freight transports is of interest (see Table 6.2 and Table 6.3). A bit more than half of the freight is sent within Sweden. A very small share of the wholesale companies' freight are exported and most of the freight is shipped domestically (> 80%). Thus most exports are conducted by manufacturing companies, particularly for more distant destinations. However these companies also generate the large domestic freight volumes (along with the large wholesale companies) but even so, the large manufacturing companies ship only a bit over 1/3 of their freight within Sweden. About 10% of the freight is shipped to our neighbouring countries Norway, Denmark and Finland, where Norway has the largest share with 4% of the freight. Interesting to note is that the terminals of intermodal road-rail transports in Norway and Sweden are shared in the same company (Cargonet) so coordination should work fairly easy. The rest of Europe represents 22% of all freight sent, which is a substantial amount, and the large and the medium manufacturing companies are dominating (85% of all freight). These transports have a distance that would fit intermodal road-rail transports well. The rest of the world has a share of about 11% and it can be assumed that a large share of freight is shipped by boat. Even so, this freight could be suitable intermodal (road)-rail-ship freight since it needs to be transported to and/or from a port. In fact, this is a market opportunity for intermodal road-rail transports to increase their current market shares on these freight flows.

*Fourthly*, the results showed the proportions of the shippers using certain transport modes, or a combination of these<sup>50</sup> (see Table 6.5). Train is mainly used by the manufacturing companies, mainly the large ones but also by the medium ones. These two groups also dominated the usage of intermodal road-rail transports. It was only a very small share of the large wholesale companies that used train and intermodal road-rail transports, and it was only a somewhat higher share of the medium wholesale companies that used intermodal road-rail transports. However, it should be noted that in many cases, the shipper is probably

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<sup>50</sup> N.B. not the weight distribution of freight volumes

unaware of whether several modes are used in the transport chain. Intermodal road-rail transports are e.g. used by large forwarders between their terminals, but the average shipper only knows that the freight is picked up and delivered by truck, thus assuming that all-road transport is used. Marketing efforts can change this lack of knowledge and in that way affect the attention and demand for intermodal road-rail transports.

*In sum*, the large and medium manufacturing companies along with large wholesale companies were responsible for about 3/4 of the freight equivalents weights sent. They had large proportions in their strata that belonged to our target population i.e. having freight transports exceeding 150 km. The large and medium manufacturing companies transported a large share of their freight more than 300 km. Train and intermodal road-rail transports were mainly used by large manufacturing companies and to some extent also by the medium manufacturing ones, where as the large wholesale companies hardly used these modes of transport. This is in accordance with previous research (Demker 2000) that shows that the manufacturing companies in Sweden using intermodal road-rail transports have more transports exceeding 300 km than on average.

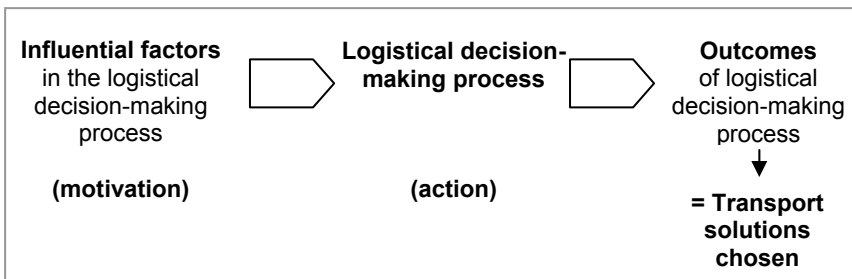
In addition, the results from the factor analysis showed that the factor ‘Modal aspects’ scored relatively low, but it was the large manufacturing companies that valued this aspect the highest. It was followed by the medium manufacturing companies and, quite surprisingly, the medium wholesale companies that received almost the same score. The large wholesale companies had a lower score. The score for the large wholesale companies is very low, and therefore intermodal road-rail transports are not a priority for these companies.

The **logistical needs** are dependent on the how the freight flows of the shippers look like and thus, their demand for freight transports. The elements of logistical value as described in theory (see Section 2.3) are service and cost minimization (Bloomberg et al. 2002; Bowersox and Closs 1996). To be value-added, it enhances the customer’s perception of a product’s value by creating economic utilities and two of these are time and place utilities (Bloomberg et al. 2002). Time and place utilities were valued very highly by the shippers. The most important aspects that influences a shipper’s choice of transport provider, and thereby the transport solution, were similar for all categories of companies. All groups of companies chose that the transport provider “fulfills commitments” (i.e. reliability) or “performs transport on time” among the top 3 priorities (see Section 6.3). The third most common was that the transport provider “covers our market area geographically in a sufficient manner”, but it was rated lower among the large and medium manufacturing companies. The shippers’ valua-

tion of various logistics aspects is discussed further in combination with environmental aspects, in the section about shippers' transport service requirements (see section 9.4).

## 9.2 Environmental management context

The influence processes regarding environmental considerations taking place among the decision-makers at the shippers may originate from various stakeholders. Stakeholder theory (Freeman 1984) has been applied on environmentalism in business in various research studies e.g. Banerjee, Iyer and Kashyap (2003) identified four important antecedents to "corporate environmentalism", where environmental concerns are integrated into a company's decision-making process: public concern, regulatory forces, competitive advantage and top management commitment. This is supported by the findings in the interview study, which resulted in a model of the impact of environmental considerations on transport buyer behavior in four Swedish companies (see Figure 5.2). This model was an extension of an earlier proposed schematic model as seen in Figure 9.2 (identical to Figure 5.1).



**Figure 9.2 Schematic model of the shippers' logistical decision-making process**

The input to this model was the motivation for environmental considerations and four influential factors were identified: transport context (including geography of company and freight volume), business aspects (price and service factors), internal environmental pressures (from senior management, the environmental function and implemented systems) and external environmental pressures (from authorities, customers, suppliers and Non-Governmental Organizations, NGO:s). A majority of the companies had witnessed an increase in freight transports, partly due to increased volumes sold. Naturally, price and service factors are extremely important but environmental aspects are taken into account to various degrees as well. Internally, it is the senior management that provides a platform for the environmental work and all four companies had an

environmental strategy, expressed in an environmental policy that also specified environmental goals. The larger companies had environmental departments internally.

One useful practice of pressure in the supply chain was the evaluation of the environmental performance of transport suppliers and it was often linked to internally implemented environmental systems e.g. an ISO 14001 certification. Historically, the authorities have been a strong external driving force for the environmental work, especially among the smaller companies, but one had turned the environmental efforts into a competitive advantage. The environmental demands from customers were strongest from those who have implemented an Environmental Management Systems (EMS) and the demands from end-customers were strongest in the two companies selling consumer products. This indicates that the consumers do have the final purchasing power in the supply chains and that they may be especially concerned about food products (one of the companies was a food retailer). The companies also co-operate externally with regard to environmental impact of logistics practices e.g. with the Swedish non-governmental organization Network for the Environment (NTM 2005), that probably has contributed to knowledge among shippers about environmental effects.

The results from the survey also showed some of the influence processes that take place at the shippers in the form of pressures from within the company and from the customers, regarding environmental demands that affect the modal choice (see Sections 7.6 and 8.3). The large companies received pressures from both customers and from within the company to the highest extent (about 25%). It was especially the large manufacturing companies that received pressures from within the company (about 65%), even when there were no pressure from customers. The group of companies that received most pressure from customers was the large wholesale companies (about 39%). There was a significant positive correlation between the demands on the outbound transports from customers and from within the company among the manufacturing companies, but a non-significant small, positive correlation among the large wholesale companies. This indicates that if the manufacturing companies receive more pressure from customers, then the pressure from the own company increases as well. This opens up for marketing aimed at consumers so they put pressure on companies regarding their transports, and thus stimulating the demand for environmentally preferable transports services.

In this context, it is vital to explore to what **degree of environmental management** the companies have reached. If a company is to be concerned

about negative environmental effects of their freight transports, then there must be a certain level of knowledge or commitment about environmental issues and the management of these in the company in general. The work accomplished can be studied through exploring the environmental management tools have been implemented e.g. environmental policies and Environmental Management Systems (EMS). Theory has shown that an EMS is also a tool for communicative action and organizational learning (Burström von Malmberg 2002). A study of European large companies showed that almost two-thirds had an EMS and that ISO 14001 was more popular than EMAS (Hibbitt and Kamp-Roelands 2002). Large multinational companies were motivated to extend EMS to suppliers (Morrow and Rondinelli 2002) and often considered it to be a way of developing a competitive advantage. In the case of transportation chain, the actors are also affected by an EMS if e.g. a company assess and communicates environmental demands to transport providers.

Research in the US by Murphy et al. (1995) showed that concern about environmental issues is greater for larger firms as well as for manufacturing firms and that logistics plays a more prominent role in the implementation rather than in the formulation of environmental policy. This is in line with the survey results in this thesis. The empirical results of the survey show how certain environmental practices are implemented in the companies (see Chapter 7). An average of 48% of the respondents had implemented a Corporate Environmental Policy, although it varied greatly between strata. A great dividend was between manufacturing and wholesale companies, where it was much more frequent in manufacturing companies, especially among the medium and large ones. The same dividend applied to the implementation of an EMS. A stratified average of 26% of the companies had implemented an EMS. ISO 14001 was the EMS most commonly chosen (92%). It can be concluded that EMS is more common in larger companies, probably because they have dedicated environmental departments and more resources put into environmental work. Also, by sending large volumes of freight, they have probably a better possibility to affect the way their freight is transported e.g. by designing transport solutions or putting pressure on transport providers.

A way of satisfying the **environmental needs** is to provide environmentally preferable transport services for transport buyers with interest in environmental improvements. Companies that have implemented various internal organizational environmental measures and receive pressures internally and/or externally from stakeholders are probably more receptive for environmental considerations as a selling argument. In marketing freight transports based on environmental arguments, it is possible to use a focus strategy by segmenting the shippers based on their priority of environmental considerations. Again, the



frequency of pressures relating to internal organization (implemented systems and demands on freight transports) and external forces (pressures from customers) was explored in the survey (see Sections 7.6 and 8.3). Also, their attributed importance towards different measures for reducing environmental effects of freight transports and their judgment of the possibility of implementation were examined. These results will be discussed briefly below.

The companies with large freight volumes, with at least 100 employees, had implemented the 18 proposed environmental measures to the highest extent and also had more pressures for environmental improvements (see Section 7.2). The most commonly implemented measures were related to general management tools e.g. a CEP and an EMS, not specific to the transport area. More than half of the companies with large transport volumes had also implemented a department or individual responsible for environmental issues. There are increased demands in the supply chains on companies today to take environmental concern into account in their business, as more and more small- and medium-sized manufacturing companies along with large wholesale companies are in the process of implementing a CEP and an EMS (see Section 7.3).

The large manufacturing companies have led the development towards an integration of environmentalism in business practices, and now these practices seem to be spread downwards into the supply chains. The question is in what pace this development moves. It seems like environmental measures of transports are considered more if the companies have already reached a certain level of environmental management, especially implementation of general management tools. This indicates that if the development towards more environmentally preferable transport services is considered to be too slow by society (represented by policy makers or politicians), it may be stimulated by demanding e.g. Corporate Environmental Reports (including the transports used for their freight) for all companies. This might increase the attention for the environmental effects of the shippers transports, especially among the smaller companies. The survey results support this view since companies that have implemented an EMS, especially among the small companies and the medium wholesale companies, are less price sensitive and willing to pay more for environmental considerations than the companies within the same strata without one (see Table 6.12). These groups of companies also have the lowest frequency of EMS-implementation (see Table 7.3). The companies that have an EMS are thus more positive to environmental considerations and therefore also to intermodal transports. This is a marketing opportunity.

The attitudes of the logistics managers towards different measures for reducing environmental effects of freight transports and their judgment of the possibility of implementation are vital when integrating environmental concerns into business practices. A factor analysis divided the same 18 measures into 5 factors (See Section 7.5). Starting with the importance of each factor, the respondents rated factors particularly relating to freight transports ('Outbound transports', 'Load factors' and thirdly 'Inter-organizational measures') the highest. The least importance was attributed to the commonly implemented measures in 'Intra-organizational measures' and 'Modal choice'.

The respondents were also most pessimistic about 'Modal choice' when it came to the possibility for implementation and this factor also had the largest gap between the importance and possibility for implementation, where the importance was rated much higher. This means that policy makers and politicians in society promoting the shifting of transport modes in order to reach a more sustainable transport system, have a difficult assignment convincing companies to use less truck transports. Also, this is a barrier for marketers of intermodal road-rail transports. However, a majority of the respondents identified the emissions of carbon dioxide/the greenhouse effect as the most negative environmental effect from their transports (See Section 7.1). This means that they should be receptive for transports that are more sustainable alternatives to trucks transports e.g. by shifting transport modes. There were mainly internal pressures regarding environmental demands that affected the choice of transport mode among the companies with large freight volumes.

### 9.3 Purchasing context

Price has traditionally been *the* most important relevant cost item to focus on in classical purchasing theory and lower prices are always preferred (Gadde and Håkansson 1993). This has however changed somewhat with alternative views e.g. network view where other aspects have been given more weight (see Section 2.4). It is clear however that price has an important role when **suppliers** are evaluated, and all purchasers have **economic constraints** in their budgets. The role of price in relation to other aspects will be discussed below regarding shippers' transport service requirements (in Section 9.4).

In the transport purchasing process, it is interesting to look at the role of contracts with transport providers since they include the transport service requirements. Starting in theory (as discussed in Section 2.3.1), Smith et al. (1997) describe how organizational buyers negotiate contracts with suppliers for a period of often 12 months, which are revised every year. This process demands

great involvement of the buyer, but it allows routine buying from established supply contracts over the year. Therefore, the contract negotiation on a longer-term when selecting transport provider is central.

A study by Engström (2004) showed that shippers often have contracts written in general terms but these are complimented by more important, but less formal, agreements regarding e.g. volumes, responsibility and contract length. Thus, a “gentleman’s agreement” is often used in the freight transport industry. This is in line with the findings in the conducted interview study (see Section 5.4.1) where “frame contracts” were often used as a base but complimented with less formal agreements. The two large companies had contract negotiations every one and a half, to two years. A majority of the logistics managers in the study asked transport providers for offers for each transport relation geographically. Also, the contracts were more important in the larger companies, while the smaller companies had minor agreements, equal to offers, instead of general contracts. However, a small company in the study always considered the transport providers’ economic situation after an expensive experience due to lack of formal contracts, when a provider went bankrupt.

The survey results show that a clear majority of the shippers contract transport providers and strata with least transport volumes contract them to the highest extent (see Table 6.7). If a company sends small volumes, the need for putting resources into transport purchasing in-house is limited and the option of letting a main transport provider take care of all transports is probably more attractive. It is reasonable to assume that as the volumes increase, so does the cost and effort. This can be compared with Woxenius (1994) who found that companies’ interest in their transports increases with the amount of freight sent. The survey also showed that the larger the company, the more contracts are used, and in addition that contracts also including other logistical services are used to a higher extent (see Table 6.8). For example, large manufacturing companies have the largest volume of goods, and their average number of long-term transport contracts is 11 which can be compared to 2.5-2.8 contracts in the strata with the small companies.

The purchasing process is based on the **economic needs** at the shippers. One of the main tasks for a purchaser is to get ‘value for money’. Price is important as a purchaser has economic constraints but also the structure of suppliers. The total economic value obtained has to be melted together with other value-adding aspects in the transport buying process. These potential trade-offs are analyzed in the next section.

## 9.4 Shippers' transport service requirements

Central concepts of the model are the shippers' transport service requirements and determining what weight shippers attribute environmental aspects along with other aspects when freight transports are bought. The resulting model from the interview study (see Figure 5.2) identified four key issues in the logistical decision-making process: trade-offs (of price, service and environmental aspects), choice of transport mode, co-operation and conflict between functions, and costs of environmental considerations. These represent the action of environmental considerations in the model.

*The first key issue* is the trade-offs. All companies in this study mentioned on-time deliveries and price, and three of them mentioned trust and environmental aspects as being important when choosing transport providers. Price was important but other aspects were required before price could be used as a principal selection criterion. The tools and methods for the evaluation of environmental considerations regarding transports were very much in a developmental phase, e.g. of transport providers. *The second key issue* is the choice of transport mode which was important, since all companies considered rail an environmentally better alternative than truck and the larger companies were prepared to pay a little more for train transports.

*The third key issue* is the co-operation and conflict between functions. The work with environmental considerations is sometimes done in co-operation with persons at the environmental function, but there are sometimes conflicting demands for transports. If the conflicts prevail, senior management has to make decisions and in that way, policies are made for future work. A majority of the companies had not yet worked out routines nor clearly decided what weight the environmental considerations should have in the purchasing process and were not an integrated part of business. *The fourth key issue* is the costs of environmental considerations. If environmental improvements are made, it may entail an initial investment in time and money but it will pay off later. However, it is probably more common that an additional amount of work is required and/or that additional costs are induced. These costs can occur within a company or between companies in the supply chain. There were discussions about how to combine economic and environmental goals, and what environmental costs would be acceptable.

The complexity of the organizational buying process was identified by Webster (1978) as one source of uniqueness in industrial marketing (along with product complexity and a high degree of buyer-seller interdependence). This complexity

is manifested in the shippers' transport requirements and the trade-offs of various dimensions of the transports bought. These trade-offs were evident in the interview study and further explored in the survey. They fall into the purchasing context in the model but will be dealt with in this section since they are closely linked to the transport requirements. The starting point was to establish what weight shippers attribute environmental aspects in comparison to other aspects. This was in focus in two data analyses conducted on the survey data:

*Firstly*, the importance of four factors was evaluated when selecting transport solution: price, transport time, on-time deliveries, and environmental efficiency. Price was valued the highest and was most important for smaller companies. The environmental efficiency (represented by emissions of carbon dioxide) was taken into account to a higher degree among those with more than 100 employees (i.e. the large and medium manufacturing companies along with the large wholesale companies), where large manufacturing companies stated the highest proportion (10%). The shares among the other groups of companies were half these sizes, or less. The calculated ratios between the points attributed to price and to environmental efficiency showed that the willingness to pay for environmental improvements of the shippers' freight transports varied. Those who scored highest on importance of environmental efficiency were the least price sensitive. Also, the size had also a greater impact on the willingness to pay, than the trade of business among the manufacturing companies. The companies with less than 100 employees are more price sensitive, but those with an EMS show a much greater willingness to pay i.e. the ratio that was 2-3 times higher than those without one.

*Secondly*, a closer examination was done regarding the importance of various characteristics of the transport providers when shippers choose transport provider. The summated scale of the factor 'Environmental aspects' was ranked fifth of the seven factors extracted in the factor analysis, before both 'IT and additional logistics services' and 'Modal aspects'. Also in this analysis, the large and medium manufacturing companies along with the large wholesale companies (i.e. companies with more than 100 employees) received the highest mean on 'Environmental aspects'. In relation to the two analyses conducted, tests of correlation between 'the environmental aspects in the choice of transport solution' and 'the environmental aspects in the choice of transport provider' were conducted (see Table 8.3), and the resulting high correlations support the convergent validity (see Sections 4.4.8). Also, the results of these two analyses, together with the fact that companies with more than 100 employees were responsible for 72% of freight equivalents weight sent, led to a filtering of respondents. In a majority of the remaining analyses including modal aspects, the companies with less than 100 employees were excluded (see Chapter 8).

#### 9.4.1 Specification of shippers' requirements

The empirical survey results in this thesis can be analyzed through the main theoretical model (see Figure 9.1). The *Logistical context* gives an over-view of the logistical situation for the shippers, on which the logistical needs are relied on. In this section, the model will be adjusted for intermodal road-rail transports, which forms part of the purpose of this thesis, by looking at certain characteristics that affect the **potential for intermodal road-rail transports**. The *Environmental management context* helps in defining the **environmental needs** of the shippers, which is assumed to originate from their degree of environmental management obtained (as discussed in Section 2.6). The *Purchasing context* includes the role of price in relation to environmental aspects and the structure of suppliers; altogether this deals with the economic needs of the shippers. In this section, the importance of price is in focus i.e. the **priority of price**. The characteristics of supplier contracts function as background information, and do not influence the priority of price.

A selection of indicators from the survey results section (Chapters 6-8) can help in defining a set of categories<sup>51</sup> for each of the three contexts, based on the characteristics of the freight flows together with the needs and preferences of the shippers. This can be applied on the total freight transport market in Sweden, but also it is interesting to do a categorization of each of the six strata, or segments. In this way, the differences between the strata are visible. The purpose is to easily get an over-view of the shippers and to be able to compare the different strata with each other. Table 9.1 provides a list of all indicators chosen with explanations. It also includes minimum-maximum values of the strata.

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<sup>51</sup> Categories on ordinal measurements (XS, S, M, L, XL) are explained further on.

**Table 9.1 List of indicators, with explanations and strata min-max values**

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**Logistical context:**

**Average weight/year;** average weight (tons per year) per company in stratum. Strata min-max: 2-200

**Proportion of total freight;** the stratum's share (%) of the total estimated freight sent/year  
Strata min-max: 7-37

**Proportion of total freight exported;** the stratum's share (%) of the total estimated freight  
exported per year. Strata min-max: 16-63

**Proportion of total domestic freight;** the stratum's share (%) of the total estimated freight sent  
within Sweden per year. Strata min-max: 10-24

**Proportion of domestic freight sent >300 km;** the estimated average share of freight (%) sent  
longer than 300 km within Sweden in the stratum. Strata min-max: 29-51

**Proportion of shippers using truck/train/(ship);;** the share of shippers (%) in the stratum that  
uses intermodal truck/train/(ship) transports Strata min-max: 0-19.7

**Market characteristics:**

**Estimated total freight;** sent per year measured in million ton equivalents, Strata min-max: 8-44.  
n'=7832.

**Number of shippers;** in the stratum belonging to the target population i.e. having transports  
exceeding 150 km. Strata min-max:131-3385

**Environmental management context:**

**Frequency of CEP implementation.;** share of shippers (%) that has implemented a Corporate  
Environmental Policy. Strata min-max: 37-92

**Frequency of EMS implementation.;** share of shippers (%) that has implemented an Environ-  
mental Management System. Strata min-max: 16-75

**Importance of CEP on transport planning;** to what extent the Corporate Environmental Policy  
affected the transport planning. Strata min-max: 3.3-4.5 (on a seven-degree scale)

**Existence of customer demands;** share of shippers (%) that receive environmental demands  
from customers affecting the choice of transport mode regarding the outbound transports.  
Strata min-max: 7-38

**Existence of internal demands;** share of shippers (%) that receive environmental demands  
from the own company affecting the choice of transport mode regarding the outbound  
transports. Strata min-max: 12-67

**Importance of environmental efficiency in trade-off;** attributed importance of environmental  
efficiency in the trade-off with price, transport time, and on-time delivery when selecting  
transport solution. Strata min-max: 3-10

**Importance of the factor 'Environmental aspects' when selecting transport provider;** aver-  
age value of the attributed importance to the factor "Environmental aspects" in the factor  
analysis. Strata min-max: 3.95-5.20 (on a seven-degree scale)

**Purchasing context:**

**Importance of price in trade-off;** attributed importance of price in trade-off with transport time,  
on-time delivery and environmental efficiency when selecting transport solution. Strata min-  
max: 46-61

**Environment/price ratio;** ratio between environmental efficiency and price from the trade-off  
question. The higher ratio, the less price sensitive is the company in relation to environ-  
mental aspects. Strata min-max: 0.073-0.327

**Importance of 'Price' when selecting transport provider;** average value of the attributed  
importance to the factor/item "Price" in the factor analysis. Strata min-max: 5.41-5.76 (on a  
seven-degree scale)

**Characteristics of supplier contracts:**

**Proportion of shippers contracting transport providers;** share of shippers (%) that contracts  
transport providers. Strata min-max: 77-100

**Number of contracts with transport providers;** average number of long-term transport con-  
tracts in use per shipper. Strata min-max: 2.5-11.0

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The ordinal categories used for each indicator are extra small (XS), small (S), medium (M), large (L) and extra large (XL); all based on percentiles. For a detailed description of this procedure and the definition of the limits for the categories, see Appendix 7 where also an extended version of Table 9.1 is found (Table A7.1). A short explanation of the summarized categories ‘Potential for intermodal road-rail transport’, ‘Environmental needs’ and ‘Priority of price’ is in place.

The **Logistical context** presents basic facts about the logistical need among shippers in each stratum, and thus showing how interesting the companies are from an intermodal point of view i.e. the potential for intermodal road-rail transports. It is favorable if the companies in a stratum e.g. have a high share of the total freight sent, a large average weight sent, and a high share of freight sent on distances longer than 300 km. Under these conditions, the stratum would probably fall into the categories L or XL on the summarized ‘Potential for intermodal road-rail transport’.

The **Environmental Management context** includes indicators showing a selection of implemented environmental measures, the presence of environmental pressures, and the priority of environmental aspects when transports are bought at the shippers. The higher values of the indicators, the higher are the summarized ‘Environmental needs’ at the shippers (e.g. L or XL).

The **Purchasing context** focuses on indicators relating to the priority of price, especially in relation to environmental aspects. If the importance of price is high (L or XL) when selecting transport providers and transport solutions (i.e. ‘Importance of environmental efficiency in trade-off’) and if the ‘Environment/price ratio’ is low in a stratum, then it would receive L or XL on the summarized ‘Priority of price’.

An over-view of the categorization of indicators for all companies, and for each of the different strata, is seen Table 9.2. The Column ‘All’ in Table 9.2 summarizes all shippers in Sweden, having outbound freight transports exceeding 150 km. The freight flows characteristics in the logistical context show a medium ‘Potential for intermodal road-rail transports’. The ‘Priority of price’ and the ‘Environmental needs’ of the shippers are categorized as being at a medium level. However, the table reveals large differences in the categorization between the six strata; small, medium and large manufacturing companies plus small, medium and large wholesale companies. An extended version of Table 9.2 (including the raw data for the categorization) is in Appendix 7 in Table A7.2.

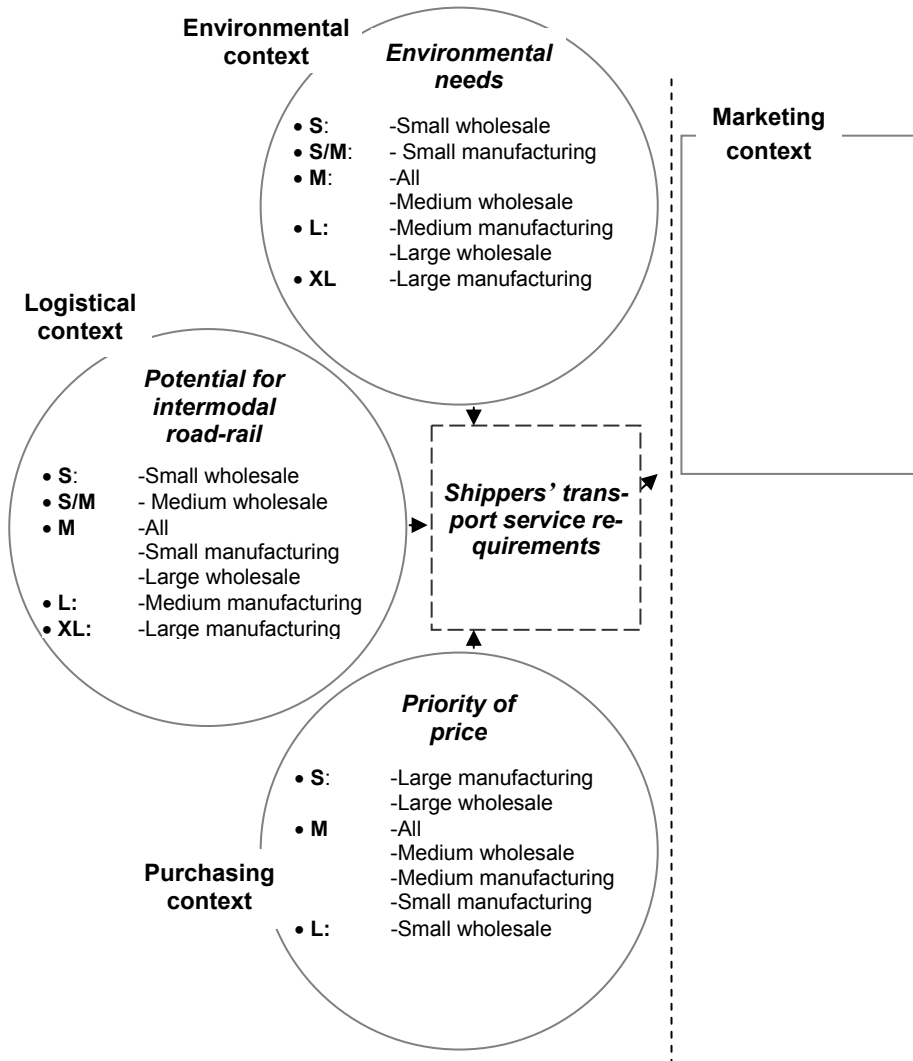


**Table 9.2 The categorization of indicators in the three contexts of the total market and per stratum**

<b>Indicator</b>	<b>Small wholes.</b>	<b>Medium wholes.</b>	<b>Small manuf.</b>	<b>Large wholes.</b>	<b>Medium manuf.</b>	<b>Large manuf.</b>	<b>All</b>
<b><u>Logistical context:</u></b>							
Average weight/year	S	S	S	L	M	XL	M
Proportion of total freight	S	S	M	M	L	XL	M
Proportion of total freight exported	XS	S	M	S	XL	XL	M
Proportion of total domestic freight	S	S	M	M	L	XL	M
Proportion of domestic freight sent >300 km	M	L	M	S	L	XL	M
Proportion of shippers using truck/train/(ship)	XS	XL	M	M	XL	XL	M
<b><i>Potential for intermodal road-rail trsp.</i></b>	<b>S</b>	<b>S/M</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>XL</b>	<b>M</b>
<b><u>Market characteristics:</u></b>							
Estimated total freight	8	8	17	13	28	44	119
Number of shippers	XL	M	L	S	M	S	7832
<b><u>Environmental management context</u></b>							
<b>Frequency of CEP implementation</b>	XS	M	M	XL	XL	XL	M
Frequency of EMS implementation	XS	M	M	XL	XL	XL	M
Imp. of CEP on transport planning	S	M	S	M	M	M	M
Existence of customer demands	S	XL	S	XL	XL	XL	M
Existence of internal demands	XS	XL	M	XL	XL	XL	M
Imp. of environmental efficiency in trade-off	S	M	M	M	M	L	<b>M</b>
Imp. of the factor 'Environmental aspects' when selecting trsp.provider	S	S	S	M	M	L	<b>M</b>
<b><i>Environmental needs</i></b>	<b>S</b>	<b>M</b>	<b>S/M</b>	<b>L</b>	<b>L</b>	<b>XL</b>	<b>M</b>
<b><u>Purchasing context:</u></b>							
Imp. of price in trade-off	L	S	M	S	M	S	M
Environment/price ratio	S	M	M	XL	L	XL	M
Imp. of 'Price' when selecting transport provider	L	L	L	L	L	L	L
<b><i>Priority of Price</i></b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>
<b><u>Characteristics of supplier contracts:</u></b>							
Proportion of shippers contracting trsp.providers	XL	M	XS	XS	XS	XS	M
Number of contracts with transport providers	S	S	S	L	L	XL	M

*Note:* the order of columns is chosen for the sake of clarity; with mainly increasing category values and the column 'All' (representing the whole market) to the right.

The main summarized categories from the three contexts, both for the total market and for each of the six strata, can be put together in a common model. This over-view is presented in Figure 9.4. The three summarized categories together form the ‘Shippers’ transport service requirements’.



**Figure 9.3 An over-view of the summated categories of each context for the total market and divided on segments (strata)**

As discussed before, the box with the shippers’ service requirements represents an important stage in the marketing process. This is where the service encounter takes place, where the shipper has the opportunity to exert pressure on the

transport provider (in best cases i.e. if the volumes are large enough), and where the transport sellers may obtain more detailed information of the needs and preferences of the shipper. This service encounter also allows marketing by the transport sellers through personal marketing of the transport services offered, including environmentally preferable transport services. This encounter is where the different contexts come together as a unit; as transport service requirements. When these three types of graded values are put together in this model, divided on groups of companies, this gives an idea of how a further segmentation of the shippers can be made based on the data from the survey. It is not only the size of company and trade of business that is interesting in a marketing context, but also the shippers' ratings on the three summarized categories. This will be discussed in the next session on customer segmentation.

## **9.5 Marketing context**

The conceptual model shows the marketing setting which is in focus in this thesis applied on intermodal road-rail transports (see Figure 9.1). The possible marketing strategies in order to make intermodal transports competitive were identified by Jensen (2007): cost advantage, differentiation and focus strategies (see Section 3.2.2). The results of this thesis can be used in marketing differentiation strategies based on environmental aspects of freight transports purchasing, supported by a focus strategy with customer segmentation. This will have consequences for e.g. transport service differentiation and marketing communication.

### **9.5.1 Customer segmentation**

An important component in the marketing of transport services is the segmentation of customers. Aaker (2001) proposed various grounds for segmentation in the customer analysis (discussed in Section 3.2.1). One that was based on the customer characteristics was size of firm. Others based on product-related approaches were usage, benefits sought, price sensitivity and brand loyalty. Some of these segmentation grounds can be adjusted to fit the purpose of this thesis and the analysis of the survey results. A segmentation ground used in the previous section and throughout the survey results sections is the strata i.e. the size of companies according to number of employees and the division in manufacturing and wholesale companies. However, three other dimensions proposed are: the environmental needs, the priority of price and the potential for intermodal road-rail transports (as discussed before in Section 9.4.1).

After the analyses of the shippers' service requirements, it is also vital from a marketing context to compare the service performance of the transport provid-

ers with the shippers' service priorities. This is also recommended by Christopher (1992), based on a process of customer segmentation (discussed in Section 3.2.1). In this thesis, this was done on the customers of transport services represented by companies with more than 100 employees i.e. how shippers perceive the performance of current transport providers on various dimensions in relation to how they rated these in importance. In this way, it was possible to scrutinize how content the customers are today with current transport providers on a number of items represented by the factors extracted in the factor analysis performed (see Table 8.1).

The aspects that were rated highest in importance by the shippers were the factor 'Basic aspects' and the items 'Price' and 'Geographic coverage'. However, the transport providers did not fulfill these requirements as much as demanded. 'Basic aspects' showed clearly the largest, and significant, difference in mean gaps (between rated importance and performance by current transport providers) among the companies with most freight sent. This was true especially among the large companies but the gap was somewhat narrower among the medium manufacturing ones. This means that the shippers in Sweden are not satisfied with the aspects that they value most. This may provide an opportunity for intermodal road-rail transports to convince shippers through marketing to try, or to expand, the use of these transports. The willingness to alter the transport planning with new ways of transporting their freight may be greater than continue with 'business as usual'.

The importance of the characteristics represented by the factor 'Environmental aspects' is in level with what the current transport provider offer among the large companies. However, the results showed a significant negative difference among the medium manufacturing companies, which indicates that the transport providers perform better than these shippers require. One possible explanation is that the transport providers are offering these shippers a good service, or another explanation is that the shippers' demands are at a low level due to e.g. lack of knowledge in environmental issues.

The factor 'Modal aspects' gave the same result among all three groups of companies; it was rated the lowest among all seven factors and the transport providers perform better than these shippers require by offering different modes of transport. Among the medium manufacturing companies, this gap was the largest one i.e. the transport providers fulfill the demands with most marginal. It is also worth noting that the companies in the three strata with most freight volumes sent showed higher means in importance regarding 'Environmental aspects' and 'Modal aspects', than those summated means based on all sizes of

companies. The question is why shippers do not pay as much importance to modal aspects, in comparison to what the transport providers offers. There might be an opportunity for marketers of intermodal transports to increase the demand for these transports by using the marketing toolbox e.g. more marketing efforts towards different segments. The pressure for environmental considerations may originate from various stakeholders. The results show that environmental demands from within the own company and from customers may directly affect the decisions on transport mode. As discussed before (see Section 9.2), the large companies received most of these pressures combined to the highest extent; the large manufacturing companies received most pressures from within the own company and the large wholesale companies from customers.

Finally, it is possible to more in detail analyze the results regarding the shipper transport service requirements in order to obtain a richer customer segmentation. In the previous section, a categorization based on indicators was made for each group of companies i.e. segment or stratum (see Table 9.2). It shows how the strata can be graded with respect to the environmental needs, and the priority of price i.e. the price sensitivity with regards to environmental aspects. Also, the basic facts about the transport flows of the strata show how interesting they are from an intermodal point of view i.e. their potential for intermodal road-rail transports. They can also be summarized in a matrix that shows how the segments could be prioritized in the marketing of intermodal road-rail transports based on environmental advantages. This is done in Table 9.2.

**Table 9.2 Priority matrix based on shippers' needs and preferences, and a resulting total marketing priority for marketing efforts of intermodal road-rail transports based on environmental advantages**

Segments (stratum)	Potential for intermodal road-rail transports	Environmental needs	Priority of price	Total marketing priority
Small wholesale	Low	Low	High	<b>Low</b>
Medium wholesale	Low to Medium	Medium	Medium	<b>Medium</b>
Small manufacturing	Medium	Low to Medium	Medium	<b>Medium</b>
Large wholesale	Medium	High	Low	<b>High</b>
Medium manufacturing	High	High	Medium	<b>High</b>
Large manufacturing	Very high	Very high	Low	<b>Highest</b>
<i>Total all</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<b><i>Medium</i></b>

The segment that should receive the highest priority in the marketing of intermodal road-rail transports based on environmental advantages is the large manufacturing companies. The medium manufacturing companies along with the large wholesale companies should also be aimed at. This customer segmentation can be the basis for marketing strategies chosen and will thus affect the decision of using differentiated marketing. This will be discussed next.

### **9.5.2 Differentiated marketing**

A strategy of marketing differentiation can be based on various possible variables but two important dimensions for the purpose of this thesis are 'product' (including transport service differentiation) and 'image' (including marketing communications), as discussed in 3.2.2. Some implications of the results for using differentiated marketing strategies will be discussed. Transport service differentiation and marketing communication will be taken as examples of how a differentiated marketing of intermodal road-rail transports is possible.

**Transport service differentiation** can be made by offering various segments different transport services, but also by emphasizing different aspects of the offer. The purpose of a differentiated marketing in the case of intermodal road-rail transports can be viewed in various ways. One view is to consider all marketing differentiation that enhances the demand for these transports as environmentally preferable as it reduces the use of road transports. Another way is to use differentiated marketing by emphasizing the environmental characteristics. A combination is also possible. Here, the second view will be in focus. How the differentiated marketing may be used will depend on the customer analysis of the shippers' needs and preferences. The survey results contribute to this.

The priority matrix in Table 9.2 showed the different needs and priorities among the various segments or strata, that may be current or potential customers of intermodal road-rail transports. The survey results showed for example relevant facts of the transport flows. After these were analyzed, it is obvious that the large manufacturing companies followed by the medium manufacturing companies, would be the main target groups for marketing of intermodal road-rail transports in existing transport structure (a high potential for intermodal road-rail transports). These companies are easy to reach, they are already using intermodal road-rail transports to a comparably high extent, and they value the modal choice to the highest extent in the purchasing process (but the large wholesale companies are not far behind). If the large wholesale companies are to be included as a target group, great efforts are needed in order to reach this group. They have sufficient volumes sent (although their share of the domestic

transports exceeding 300 km is small), but they are hardly not using train or intermodal road-rail transports today.

In this discussion about the target groups for marketing, it is mainly the classical form of intermodal road-rail transports (where large terminals are used with a reloading system for full-sized interchangeable load carriers) in focus. However, the groups of companies with a medium potential for intermodal road-rail transports, or even small, does not have to be ruled out as target groups. Their freight flows might fit for smaller scale intermodal road-rail options, so-called 'light' intermodal solutions, where smaller load carriers are used along with only a truck for loading/reloading (instead of a large terminal). The small manufacturing companies and the medium wholesale companies (medium environmental value) might be suitable also for traditional intermodal road-rail transports, but this demands more organizational planning e.g. new implemented systems and common points of consolidation for freight in order to be cost efficient. This involves horizontal co-operation. For example, current research in Sweden (Bergqvist and Pruth 2006) shows how public and private partnerships in regional logistics networks can contribute to the competitiveness of firms and improve institutions' planning and design processes. Many times these networks includes e.g. coordinated intermodal transports in the region. However, the survey results show that these groups of companies do not give as much weight to the environmental aspects i.e. a lower environmental value, especially among the small wholesale companies. Therefore, marketing of intermodal transports to these companies should not focus on the environmental advantages, at least at present.

Thus, the environmental aspects of intermodal road-rail transports can be viewed as a marketing potential where the actors offering these transports may offer something different than the competitors i.e. a form of product differentiation. In this case when the marketing of intermodal road-rail transports must be interpreted in a broader sense with various interested actors (not only transport providers but also other stakeholders in society), the competing alternatives are mainly road transports. Environmental product differentiation was discussed before (in Section 2.5.1) where the point of departure in theory was Reinhardt (1999) and the three conditions that must be met in order to succeed with this differentiation. *The first condition* was to identify customers that are willing to pay more for an environmentally better product or service, in this case freight transports. The results of the interview study showed that it was difficult for the shippers to express to what extent they value environmental considerations when selecting transport solutions, but one interesting fact was that a large company had formally decided that an transport option including rail could cost a certain percentage more compared to a road option.

The shippers in the survey did not rate “to have one of the lowest prices” as a basic requirement when selecting transport provider, although the respondents gave price on average a 58% “weight” when selecting transport solution. A conclusion is that price was important, but it does not have to be one of the lowest, as it is more important that the basic transport requirements are met (e.g. deliveries on-time). This conclusion was also drawn in the interview study as the total value of the offer was most important, rather than price alone, when logistics decisions were made. This is supported in previous research. Engström (2004) concluded that most shippers in his study stated that price was not the most important variable in the selection process of carrier/coordinator, although price can be decisive when a certain qualitative minimum level is reached. Anderson and Narus (1998) proposed that value is not the same as price since the value is what the customer gets in exchange for the price she/he pays, and to raise or lower the price on the market offer does not change the value of it to the customer. This implies that transport providers offering environmentally preferable transport services e.g. using rail or intermodal rail solutions to customers that value environmental aspects might have an opportunity to gain market shares from the competitors that do not enhance this aspect. The groups of companies that had a low priority of price in the priority matrix in Table 9.2 (and were thus less price sensitive in relation to environmental aspects) were the large companies. The medium-sized companies and the small manufacturing companies were at a medium level, whereas the small wholesale companies were the most price sensitive.

*The second condition* was communicating the product’s environmental benefits credibly, which falls into the marketing communication domain. The results of the interview study showed that when more efficient logistics solutions were introduced for economic reasons, this also meant less environmental effects e.g. use of return transports to a greater extent and high load factors of trucks. On the other hand, there was a risk associated with the trend of greater demands on shorter delivery times and smaller but more frequent shipments, which some of the companies had experienced. The shippers participating in the survey were well aware of the environmental problems caused by their transports. A majority identified the emissions of carbon dioxide or the greenhouse effect as the most negative environmental effect from their transports. This implies that the shippers should be receptive for alternatives to truck transports by shifting modes. The role of marketing communication will be discussed more further on.

In the interview study, a majority of the logistics managers believed in an increased usage of intermodal road-rail transports in the future if only the other demands could be met. The survey results show that the shippers are largely dissatisfied with their highest valued requirements, included in the factor ‘Basic



aspects'. This means that dissatisfied shippers might be willing to try new transport solutions, including shifting transport modes, instead of doing "business as usual" with poor results. This perceived poor, general quality is an opportunity for intermodal road-rail transports. There was also a significant correlation between the factors 'Modal aspects' and 'Environmental aspects'. This synergy effect can be used in the marketing. If the service preferences of the 'Modal aspects' are increased, then the requirements of the 'Environmental aspects' are raised also. Rather it should be the other way around since 'Environmental aspects' were rated higher in importance than 'Modal aspects'. Marketing can contribute in this by promoting environmentally preferable transport services, which thus will also increase the demand for other modes of transports than truck. The environmental advantages of intermodal road-rail transports are a major opportunity to expand their market shares and they should be used in a differentiated marketing strategy towards selected segments. In the priority matrix in Table 9.2, it is evident that these transports would provide the highest environmental value to especially the large manufacturing companies but also to the medium manufacturing and large wholesale companies.

*The third condition* of Reinhardt was to protect the company from imitation long enough to get profit on its investment. In the case of intermodal road-rail transports, today's structure shows that there are a limited number of operators. In the recent years, there has also been a slow but steady increase of the shares of freight shipped by intermodal road-rail transports in Sweden (Näringsdepartementet 2006). The amount of transports had increased in all companies in the interview study which implied a growing interest in new transport solutions, and will probably increase even more in the future, especially since many of the companies had experienced a higher cost for transports for the past few years. This may be a market opportunity for intermodal road-rail transports. Next, environmental arguments in the marketing communication will be discussed.

**Marketing communication** is an important component in differentiated marketing based on the dimension 'image'. It has a role in strengthening the connection between environmentally preferable transport services and intermodal road-rail transports in the minds of the shippers. However, an important contribution of the survey results is that they show a strong relationship between environmental aspects and modal aspects to the shippers. This can be built further on in the marketing of intermodal road-rail transports. The marketers will have to communicate with the shippers about the environmental advantages in a balanced way backed up with facts. It is important to bear in mind that the history of green marketing has many examples of "green wash", a fact that may have affected the receivers of marketing negatively.

There have been marketing efforts of transport providers in Sweden for environmentally preferable transport services. One example is the large freight forwarder on rail in Sweden, Green Cargo that uses environmentally labeled electricity as a way of signaling environmental value. Another recent example is a new CO<sub>2</sub>-neutral transport service offered by DHL Express, as the company states that 40% of their customers are willing to pay 2-25% extra for this service (Ovesen 2006). Another example is Schenker Logistics that has an Emission calculation online service to help their customers to determine the total environmental load caused by transport and logistics systems within the company's European land transport network (Schenker Logistics 2006).

In the marketing communication process, it is important to examine what is needed in order to affect the target group and by what means, as discussed in the analysis of the research problem in Section 3.3. Firstly, who are the potential senders, the marketers, of the message i.e. environmental arguments for the marketing of intermodal road-rail transports? Secondly, who are the target groups and what are the desired effects?

Regarding the *first* issue, there are various alternative **senders, or marketers**. According to Peattie (1995), the fact that consumers and societies have multiple and sometimes conflicting wants and needs is one of many key elements of environmental marketing. This is relevant regarding environmental aspects of freight transportation as decision-makers in society e.g. politicians may not have the same needs, neither goals, as shippers. Naturally, the intermodal road-rail transport companies have an obvious interest in using environmental arguments in the marketing of these transports for increasing their share of the total transport market. At present, the main company in Sweden selling these transports to shippers and forwarding agents is CargoNet.

In addition, shippers may have an interest for relieving the pressure on trucks. It can be seen as a risk diversion strategy, as various factors may threaten the dominance on truck transports in the near future. This may involve legislation or taxes with the aim of making the competition between modes neutral i.e. to let each transport mode bear its cost, including external costs. There may be a shortage of truck drivers, which limits the number of haulers available, which in turn may boost prices. Not to mention the explosive problem with congestion, especially in continental Europe e.g. Germany, but also an increasing problem around the large cities in Sweden: Stockholm and Göteborg. An increased demand from shippers for environmentally preferable transport services and/or increased number of rail transports, may offer expanded business opportunities for transport providers as well.

The *second* issue concerned the **target groups** and the **desired effects**. Potential target groups for marketing depend naturally on who the marketers – the senders – would be. An important consideration is scrutinizing what purpose each group would have in using environmental arguments in the marketing of intermodal road-rail transports. The actors in the intermodal transport chain have an economic interest in selling as much intermodal transports as possible. Their target groups would be companies interested in increasing their share of rail and intermodal road-rail transport, and companies experiencing pressure from stakeholders to increase the environmental considerations of their business, including transports. An example is the results of the analyses regarding shipper service requirements which showed that companies with more than 100 employees value environmental aspects to a higher degree than small companies and medium-sized wholesale companies (see Section 8.1). Also, the same groups of companies were responsible for 72% of freight equivalents weight sent and this may help in the differentiation of transport services, so that the marketing can be different to various customer segments. The main conclusion from the priority matrix in Table 9.2, is that the large manufacturing companies should have the highest marketing priority, followed by the medium manufacturing companies along with large wholesale companies.

It is however clear, from a demand-driven view, that the shippers play a key role when selecting transport solutions as their choice affects the whole transport chain and the logistics managers have a key role for this, which also Wu and Dunn (1995) pointed out. Also, this group is not homogeneous as the results show and there are possibilities of service differentiation, as discussed previously, based on how they value different aspects e.g. environmental considerations and modal aspects. The identification of the decision-makers among shippers is vital in marketing of transport services and the results (see Table 8.5) showed that the choice of transport providers was mainly made by the Logistics managers. The same applied to the selection of transport mode but it was also often the customers' choice to a quite high extent, especially among the medium manufacturing companies where about one third of the shippers had this arrangement. In sum, the customers have more influence on the choice of transport mode than of transport provider. The transport providers were involved to a limited extent in the modal choice (see Table 8.6), according to the shippers. The identification of decision-makers is useful knowledge in reaching target groups and e.g. can be used in marketing communication of environmentally preferable transports services.

Actors at the macro-level, i.e. of society, would probably be mainly interested in using the intermodal transports as a mean to relieve the freight transport on road by moving more freight to rail, and in that way decrease the total environ-

mental impact of transports. The purpose of the marketing would then mainly be to use the environmental argument in cases when the intermodal road-rail transports are motivated by an environmental gain. This means that the shippers sending freight on distances >300 km are the main target groups, even if shorter distances could be of interest as well. This indicator is included in 'Potential for intermodal road-rail transports' in the priority matrix in Table 9.2 where the large and medium manufacturing companies were identified as having the highest potential. The target groups of e.g. public authorities would be politicians who can affect the legislation that would favor intermodal freight transports e.g. that each mode pay their own external environmental costs. If the marketers are at the macro-level, it is still the shippers' preferences that form the demand for intermodal road-rail transports, and are thus important. The political will is present today to increase the intermodal road-rail transports, but it is rather a question of changing the transport buying behavior of the shippers.

It is extremely important to penetrate the **purpose** of marketing before using environmental arguments in the marketing communications of intermodal road-rail transports. A relative issue concerning the target groups is the identifying the desired effects in the marketing communications. The aim is to make the target groups aware of the intermodal transports based on their beneficial aspects from an environmental point-of-view. Also, recall that 'Modal aspects' were valued lower than 'Environmental aspects' in the factor analysis. This is a market opportunity as many companies have stated in their environmental policy that more freight should be transported by rail. If environmental arguments are to be used in the marketing communication of intermodal road-rail freight transports, it is important to know whether the buyers of transport services associate environmental aspects of transportation with those of modal choice. The findings of the survey (in Section 8.5) showed a positive, significant correlation between Environmental aspects and Modal aspects which confirmed the hypothesis that shippers (in companies with more than 100 employees) who value 'Modal aspects' highly also appreciate environmentally preferable transport services. This will facilitate the marketing communication towards shippers..

It must be emphasized again, that many shippers today are not aware of the fact that their transport provider utilize intermodal road-rail transports. A first step in the marketing communication of intermodal transports is to create awareness among shippers when it is used i.e. a type of branding towards the customers. This is an opportunity for the marketers of these transports.

This section about differentiated marketing aimed at showing the prerequisites for this strategy in the marketing of intermodal road-rail transports. The dimensions 'product' and 'image' were taken as examples and therefore included a

discussion around the possibility for transport service differentiation and marketing communication. A more detailed description of these possible marketing programs is not within the scope of this thesis (as discussed in Section 3.2). However, all marketing strategies or marketing programs relies on the demands and needs of the shippers.

## 9.6 Shipper's choice

It is the transport service customers that make the ultimate choice of transport providers, but also of transport mode. This choice is often a quite complex process but two factors are critical: the customer value and the price offered by the transport seller.

### 9.6.1 Customer value

The goal of marketing is to create customer value to freight transport service customers. The starting point was that companies buying freight transports have reached different levels of advancement in environmental management including various implemented systems e.g. EMS and how to view a potential environmental value. This affects to what extent environmental considerations influence the decision-process of transport services purchasing. These then are combined with other logistical service requirements and economic constraints in purchasing, as total customer transport service requirements. These are put forward to the transport providers selling transports and brought into their organizations in a marketing context.

The transport providers can use customer segmentation in order to effectively use differentiated marketing to certain target groups. One way is by offering intermodal road-rail transports to those shippers with the highest environmental needs, with most potential for these transports and that have a relatively low priority of price. In this way, the shippers' total transport service requirements can be satisfied and the transport providers have created customer value for them. This perceived customer value improves the chances of developing a long-term relationship between the transport providers and these target groups.

### 9.6.2 Price

The focus in this thesis does not stem from the service production, but rather with the demands and preferences of shippers in the marketing context. However, it is in the **service production context** the minimum price of the transport services is set and in this thesis, price is considered as a fixed output of this

context. It is assumed to originate from two main sources that in turn include a whole range of components; the **operating cost efficiency** and the **transportation network structure and investment**. The goal of the service production among transport sellers is to offer a competitive price to freight transport service customers. At the same time, this price must cover the costs of the transport service production and generate a surplus. The cost of intermodal road-rail transports per ton kilometer is decreasing with distance, with larger volumes of freight and with regularity in the freight flows. At the same time, the freight transport market is very competitive and there is constant pressure on prices. Price is important as the shippers have economic constraints in their purchasing context. As noted before, it should not be confused with the concept of value though.

As shown in the results discussed above, there has been an attempt to examine what weight the shippers attribute to price in relation to environmental considerations of the transports purchased. This was discussed above regarding customer segmentation in Section 9.5.1. The priority matrix in Table 9.2 showed that the large companies were the least price sensitive in relation to environmental considerations. At the same time, these companies acknowledge the environmental value of the services offered the highest (especially the manufacturing ones), along with the medium manufacturing companies i.e. the companies with most freight volumes.

The environmental costs of transportation today is, to a large extent, covered by society, but this might change in the near future, since politicians in the European Union want to internalize these costs so that each mode of transport carries its own costs. This will probably make transport modes that are better from an environmental point of view e.g. where train is included, more appealing to shippers, since road transports can be expected to be priced higher. For example, a kilometer tax is under consideration in Sweden and this may also influence the demand for intermodal road-rail transports. It is clear that the pricing of the different transport modes may change quite rapidly if the policy-makers decide to integrate society's external costs of the environment into the business costs i.e. the prices. The companies that are proactive ahead of this development might then have a competitive advantage in relation to other shippers.

## 9.7 Implications of the results

Although the results have been discussed in terms of a marketing context among transport sellers, these results may also be useful to other parties interested in the opportunities of developing environmentally preferable transport

services e.g. intermodal road-rail transports. The results regarding the shippers' preferences and attitudes can in research be used in the examination of the possibilities and willingness to improve the environmental performance in regard to freight transports, and to look at the potential Swedish companies have in contributing to achieve a sustainable transport system in a voluntary way.

Meantime, the problems with global environmental challenges, especially with the greenhouse effect, are accelerating. With this in mind, there is a possibility that representatives for society finds these voluntary, proactive business processes to be evolving in a too slow pace. Then there are political and economic incentives at hand in order to increase the pace of the demand for environmentally preferable transport services. Some possible tools are e.g. to allow tax relives or require by law that companies disclose how their transports are performed from an environmental point of view in a compulsory Corporate Environmental Report. The empirical results in this thesis may form part of the basis of political decisions.

There are other communicative tools that can be used in order to promote more sustainable ways of transporting as well. Since business practices including measures to reduce negative environmental effects of transports are still largely in its infancy and the pressure from stakeholders is present, there is a need for information. To society, this presents opportunities to support increased communication in these issues and to assist logistics managers in both the public and the private sector with relevant information to guide the implementation of practices. This can be done through supporting existing Non-Governmental organizations working with these issues e.g. NTM (2005) in Sweden.

The results regarding shippers' attitudes and preferences of environmental aspects gave insight about not only the current state but also a future-oriented approach to the valuation of environmental aspects. These preferences are measured at a point in time, and these may change in a near future. This depends of how the voluntary business practice evolve, how urgent the negative environmental consequences appear and how the external costs of the environment are regulated by society in legislation. All together, it is a challenge to business to adapt but also to contributing to making the transport system as sustainable as possible.





## 10 Fulfillment of research questions and contribution

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In this chapter, it is time to evaluate what difference this thesis makes. This is done by starting out on a small scale by looking at the fulfillment of the research questions that were formed in the first part of the thesis. The contribution of the thesis as a whole is then discussed.

### 10.1 Fulfillment of research questions

This section aims at summarizing in what way the collected empirical data contributed to the work of analyzing the research problem in this thesis. The purpose was:

*to explore the potential of using environmental arguments in the marketing of intermodal road-rail freight transports.*

In order to fulfill the purpose, three research questions were set up. It is worth taking a closer look at the results obtained and in that way examine whether the research questions have been answered and whether the knowledge needs identified (see Table 3.2) can be considered fulfilled in a satisfactory way.

#### **1. What impact do environmental aspects have on shippers and their customers?**

*Firstly, it was necessary to investigate to what extent environmental measures are considered and integrated among shippers.*

This was mainly explored in Chapter 7, and to some extent also in Chapters 5 and 6. The interview study (Chapter 5) showed that the larger companies had

dedicated environmental departments and worked actively with environmental aspects of transportation. There were however both conflicts and co-operation concerning environmental considerations among departments and the conflicts many times originated from the financial side of environmental concern. The survey results regarded implemented environmental policies and EMS; what measures are regarded as important and what are the possibilities for implementation; what measures are already implemented etc.

*Secondly, it was relevant to explore if there are any pressures for environmental considerations of transports present in the supply chain.*

This was mainly explored by looking at whether there were any internal and external pressures on the companies, but also in the form of environmental demands on the choice of transport mode from customers and/or from their own company. In the results of the interview study (Chapter 5) influential factors in the logistical decision-making process were identified that functioned as motivations for environmental considerations: transport context, business aspects, internal environmental pressures and external environmental pressures. The results from the survey (Chapter 8) showed the relationship between the existence of environmental demands affecting the transport mode, from customers and from within the company regarding their freight transports.

## **2. If environmentally preferable transport services are offered, are they value-adding to the shippers?**

*This involved exploring how important environmental aspects are, along with other aspects such as price and service qualities, when freight transports are purchased.*

This was mainly explored in Chapters 5, 6 and 8. The results of the interview study (Chapter 5) showed that one large company had formally decided that transport options involving rail could cost a certain percentage more than a road option. It was concluded that there existed trade-offs when freight transports are purchased, which was one of four identified key issues in the logistical decision-making process. All companies in the study mentioned on-time deliveries and price, and three of them mentioned trust and environmental aspects as being important when choosing transport providers. Price was important but other aspects were required before price could be used as a principal selection criterion.

In the survey, the trade-offs were further investigated. The shippers did not rate “to have one of the lowest prices” as one of the basic requirements when selecting transport provider, although the respondents give price on average a 58% “weight” when selecting transport (Chapter 6). One conclusion is that price is important, but it does not have to be one of the lowest prices, as it is more important that the basic transport requirements are met. Again, this conclusion was also drawn in the interview study. The importance of four factors was evaluated: price, transport time, on-time deliveries, and environmental efficiency. Price was valued highest and was even more important for smaller companies. The environmental efficiency (represented by emissions of carbon dioxide) was taken into account to a higher degree among those with more than 100 employees, where large manufacturing companies stated the highest percentage (10%). The groups of companies with less than 100 employees stated half or less that share.

Another analysis focused on the importance of various characteristics of the transport providers when shippers choose transport providers (Chapter 8). A factor analysis that was conducted identified seven factors. The summated scale of the factor ‘Environmental aspects’ was ranked fifth of the seven factors extracted in the factor analysis, higher than both ‘IT and additional logistics services’ and ‘Modal aspects’. The same three strata as in the analysis when transport solution was chosen received the highest mean on ‘Environmental aspects’. To these companies, with a clear majority of the freight transported (measured in freight equivalents), environmental considerations may be value-adding to the transport purchaser i.e. the logistics manager. After the analyses of the shippers’ service requirements, it was also vital from a marketing perspective to compare the service performance with their service priorities. The shippers rated how their current main transport provider performed on the same characteristics that they had rated in importance, so that gaps of satisfaction were identified.

*It was also necessary to explore the possibility of preferences of environmental aspects changing in the future.*

This was done through a question where the respondents were asked to rate the importance of 18 measures in order to reduce the environmental impact of their transports, and also their opinions of the possibilities for implementation. A factor analysis identified 5 factors and the ratings could be compared for each factor. In a majority of factors, there was a significant difference between the importance and the possibility for implementation where the importance was rated higher. Since the importance was valued higher, there is a great possibility

that these measures will receive a higher priority for implementation in the future than under current conditions.

### **3. Is it effective to use environmental arguments in marketing strategies of intermodal road-rail transports?**

*In this case, it was necessary to explore the link between environmental aspects and modal choice among shippers.*

The results from the survey (Chapter 8) showed that there was a positive correlation between the valuation of environmental aspects and the modal choice, so shippers that highly appreciate environmental considerations of their transports, mainly large manufacturing companies but also medium manufacturing companies to some extent, also value that the transport providers offer various modes of transport apart from truck. This would facilitate the marketing communications aimed at these groups and make the use of environmental arguments effective.

*Also, it was relevant to explore if any segmentation of shippers could be made based on environmental concern and modal choice.*

This was mainly assessed from the results of the survey (Chapters 6, 7 and 8). The transport patterns were analyzed (Chapter 6) and a conclusion was that the large manufacturing companies, and to some extent also the medium manufacturing companies, would be the main target groups for marketing of intermodal road-rail transports in existing transport structure and based on the valuation on modal choice among shippers. These companies also valued environmental aspects the most in the factor analysis conducted (Chapter 8), even though they seem content with what the current transport providers offer today. The demand for modal aspects is today on a lower level than the transport providers offer, but this demand can be stimulated to these selected target groups through marketing communication emphasizing the environmental advantages of intermodal road-rail transports.

## **10.2 Contribution of thesis**

This thesis has both theoretical and empirical contributions to current knowledge concerning the marketing of environmentally preferable transports services, in particular intermodal road-rail transports.

Firstly, there are **theoretical contributions**. The main contribution consists of the resulting model for the marketing of environmental advantages in freight transportation (see Figure 9.1). This model was based on the theoretical framework elaborated in Chapter 2 (see Figure 2.1) which in turn contributed to, probably for the first time, bringing together theory in marketing, logistics, purchasing and environmental management. The model was used in the concluding discussion, but this model can also be used in a managerial setting when analyzing the marketing of environmentally preferable transport services. In addition, the proposed model based on the conducted interview study (see Figure 5.2) may help in scrutinizing environmental considerations in the logistical decision-making process among shippers. All together, this has extended the knowledge in the four theory fields discussed above.

There is also another theoretical contribution in terms of methodology and survey design. The conducted survey study has been discussed in detail (see Chapter 4) in order to describe the theoretical and practical problems when a survey is carried out. These barriers could be identified due to the use of a telephone-initiated method, and therefore raised issues of reliability and validity that are normally not described. In the worst case, it is possible to be unaware of the potential bias induced in the data collection. Therefore, this method applied has a theoretical contribution to the design of surveys carried out in practice in the logistics area.

Secondly, there are **empirical contributions**. There are the data collected among shippers that form the basis for the freight transport demand that can contribute to those interested in examining the freight transports in Sweden e.g. practitioners and researchers in logistics but also politicians. The most important practical contribution though, is the results of the survey reflecting the attitudes and preferences of shippers regarding environmental aspects (especially in relation to their transports) in combination with other important aspects. In this thesis, they were combined with the modal choice in order to analyze the opportunities for environmental marketing for intermodal road-rail transports. The empirical results in this thesis may help transport sellers to analyse the market for their transports, but they may also form part of the basis of political decisions.



## 11 Suggestions for future research

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This thesis has analyzed environmental considerations in transport buying behavior among shippers in Sweden. The approaches chosen have produced results built on the shippers own statements and self-reported attitudes, that may help in giving insight on the role of environmental considerations in the complex transport buying process. The empirical data collected through the conducted survey within the frames of this research project are very extensive, where this thesis is built only on a limited piece. However, the scope of this thesis can be explored further by doing more analyses on this collected data, but it is also possible to collect further empirical data using other methodological approaches than in this thesis.

The segmentation of shippers in this thesis is mainly based on the stratum variable i.e. the size of companies according to number of employees and the division in manufacturing and wholesale companies. Other possibilities when analyzing the environmental aspects or the modal choice, is to segment the shippers according to other variables. The survey has provided a whole range of background data of the companies which enable a variety of possible analyses by using multivariate statistical methods. For example, cluster analysis could be used in order to identify segments of shippers and more in detail show common features among those who rank environmental aspects highly. Another path would be by using regression analysis in order to use segmentation broken down to more specific trades of business.

In terms of further research involving new data collection, it could involve studies among transport providers that can be contrasted to the results from the shippers' perspective. The supply side could then be linked to the demand side. It would be interesting to use a shorter modified version of the survey used in this thesis, and to discuss it with the marketing persons among transport providers. For example, they could be asked to judge how their customers would rate

the different aspects/factors of their services. Also, it would be interesting to analyze in what way they work with customer segmentation and whether they base it on environmental considerations and/or modal aspects. This may be done through interviews with marketing and sales persons among transport sellers.

In the model of analysis from the theoretical framework, that was used also when the conclusions were presented, there were two important points of encounter between transport sellers and transport customers: when the shippers' transport service requirements were specified and when the shippers made their choice of transport providers. If a transport seller is then chosen, it is time for signing contracts and reaching a final agreement about the terms and conditions of transport services. These two encounters are vital from a marketing point-of-view. Another path involving new data collection but using different research methods would be to study these encounters in depth. This could involve participatory observation of the researcher and can be complemented with interviews. This would reveal the buyer-seller interaction process and if/how environmental aspects and modal choice are present in these discussions.

These were a few suggestions for further research on environmental aspects in connection to intermodal transports. Transport research has evolved during the last decade, but emphasis is still on technical aspects which are indeed needed. However, more organizational studies are needed in order to build up knowledge to uncover mechanisms for change. This might contribute to changing behavior of actors in the market which may induce a sustainable transport system in the future.



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## **APPENDICES:**

***Appendix 1:*** Net of terminals for intermodal road-rail transport

***Appendix 2:*** Interview guide used in explorative interview study (semi-structured)

***Appendix 3:*** Cover letter and survey questionnaire (in Swedish)

***Appendix 4:*** Survey question 24 for factor analysis (in English)

***Appendix 5:*** Survey results on priorities per stratum, on-time deliveries and damaged goods

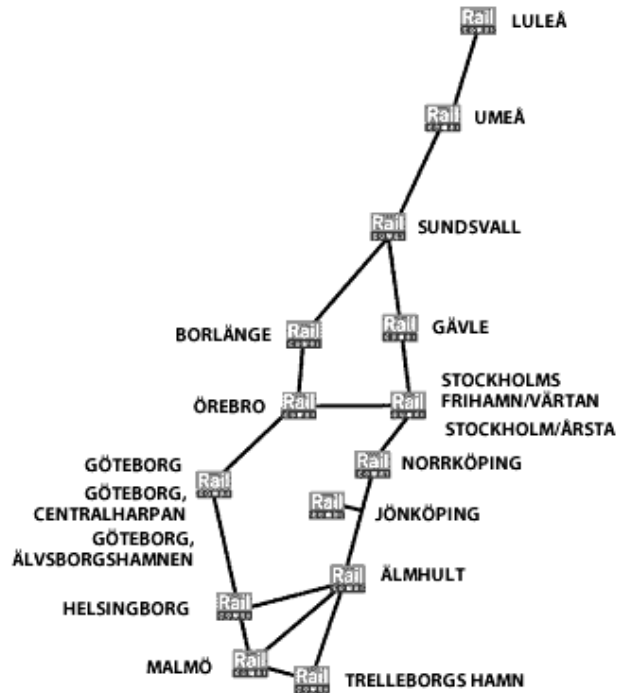
***Appendix 6:*** Additional gap analysis of environmental measures (Wilcoxon Signed Rank Test)

***Appendix 7:*** Specification of shippers' requirements per stratum



## Appendix 1: Net of terminals for intermodal road-rail transport

The terminals are run by CargoNet, which is formerly Railcombi. This is an over-view of the terminals when Railcombi was the owner:



The net of CargoNet is seen on the next page. Note that the terminals in Sweden are located at the same cities as when Railcombi owned them.

The net of CargoNet (CargoNet 2006):



## Appendix 2: Interview guide used in interview study (semi-structured)

- What is your company's business?
- How is your company organised?
- What transports are needed? (inbound/outbound)
- How are your goods transports performed today?
  
- What transport services are bought and by whom?
- Why these?
- What criteria are you evaluating?
- What demands do you have on a transport?
  
- What demands are put forward when goods transports are purchased?
- What importance does the environmental aspect have when you purchase (transports)?
- Is there a discussion with the transport seller about these issues?
- What modes are transports do you consider as environmentally better? Why?
- Do you buy intermodal transports (especially road-rail) and train transports? How large are their shares?
  
- Are environmental considerations taken into account when goods transports are purchased and when choosing transport mode?
- How do you consider environmental considerations and e.g. price, other services etc?
- What environmental consequences do your goods transports have?
- Do environmental considerations matter among the customers?
- What role does your transport provider have when transports are bought?
- Are environmental arguments used in the marketing / as a selling argument of the transport providers?
  
- Think of a transport between Göteborg and Stockholm. What transport do you buy and why? (Can be exchanged for their most commonly used transport relation)
- What are the price differences between the transport alternatives? (%)

- Are there any trade-off between price and environmental considerations?
- Do you prefer truck or intermodal road-rail transports / train transports, and why?
- Are there any price differences?
  
- What attitude / interest do the transport providers have regarding the environmental aspects when they choose transport mode?
- What attitude / interest do the transport providers have regarding intermodal transports?
  
- What knowledge do you have regarding environmental consequences of different ways of transporting? Do you calculate these and how?
  
- How is your environmental work organised?
- How is your environmental work performed? (activities, actions etc)
- Have you implemented an EMS e.g. ISO 14001?
- Do your company work in other way with the environmental issues?
- Do the senior management have any strategies for the environmental work?
- What environmental demands are put forward?
  
- Do your customers put forward any question or demands regarding how you transport?
- Do your suppliers put forward any question or demands regarding how you transport?
  
- Do you use environmental arguments in the marketing and in that case how?
- Do you use environmental arguments about how you transport in your marketing, and in that case how?
  
- How is the development with transports for your company? Any trends?
- What will be important within the next few years?
- What will be important within the longer term (5-10 yrs)?
  
- Anything you want to add?



## Appendix 3: Cover letter and survey questionnaire (in Swedish)



Handelshögskolan  
VID GÖTEBORGS UNIVERSITET  
FÖRETAGSEKONOMISKA INSTITUTIONEN



### Näringslivets godstransporter – fakta och önskemål

Denna enkätundersökning utförs av Forskningsgruppen för logistik och transportekonomi, Handelshögskolan vid Göteborgs universitet. Undersökningen syftar till att öka kunskapen om hur kostnads- och miljöeffektiva godstransportsystem med hög leveransservice bör se ut i framtiden. Detta är en förutsättning för att öka näringslivets konkurrenskraft. Undersökningen ingår i ett större forskningsprogram som bedrivs gemensamt av Chalmers Tekniska Högskola och Handelshögskolan vid Göteborgs universitet.

Vi önskar att enkäten besvaras av den som är ansvarig för inköp av utgående godstransporter. I den mån samtliga frågor inte kan besvaras av Er, var vänlig att vidarebefordra enkäten till den person som bäst kan besvara resterande frågor.

Era svar kommer att behandlas konfidentiellt. Endast resultat i vilka enskilda uppgiftslämnare inte kan identifieras kommer att publiceras.

Det är nödvändigt med en hög svarsprocent om vi ska få representativa resultat. Därför är Ert svar synnerligt viktigt. Vi hoppas därför att Ni kommer att besvara vår enkät och därmed bidra med Era kunskaper om dagsläget och vilka behov det framtida transportsystemet bör tillgodose.

Tack på förhand för Ert svar.

Med vänlig hälsning

Arne Jensen

Professor i transportekonomi  
Forskningsgruppen för logistik och transportekonomi



Handelshögskolan  
VID GÖTEBORGS UNIVERSITET

## Näringslivets godstransporter – fakta och önskemål

Denna undersökning avser huvudsakligen Ert arbetsställes utgående godstransporter överstigande 150 km. Om Ert arbetsställe inte har några sådana transporter, ber vi Er fylla i denna sida samt fråga ett och två på nästa sida och därefter skicka in enkäten i det portofria svarskuvertet till oss. Det är mycket viktigt för oss att Ni sänder in enkäten, även om Ni inte har utgående godstransporter.

Vilket ansvarsområde har Ni på Ert arbetsställe?

- Samtliga godstransporter  
 Vissa godstransporter, nämligen:

.....

Svaren i enkäten innefattar:

- Arbetsställets samtliga transporter  
 Endast de transporter som jag ansvarar för

Om Ni inte kan besvara alla frågor i enkäten, var god lämna över den till lämplig person på Ert arbetsställe för kompletterande svarsinformation.

Enkäten besvarad av:

Namn \_\_\_\_\_

Befattning: \_\_\_\_\_

Arbetsställe: \_\_\_\_\_

Postadress: \_\_\_\_\_

E-post: \_\_\_\_\_

Telefon: \_\_\_\_\_

Övriga frågor i enkäten har besvarats av:

Namn \_\_\_\_\_

Ansvarsområde: \_\_\_\_\_

Befattning: \_\_\_\_\_

Arbetsställe: \_\_\_\_\_

Postadress: \_\_\_\_\_

E-post: \_\_\_\_\_

Telefon: \_\_\_\_\_

Enkäten är inte tillämplig för oss, därför att:

- vi inte har några utgående godstransporter  
 vi har utgående godstransporter, men alla är kortare än 150 km

Var vänlig ange här vilken enhet som Ni avser att använda när Ni besvarar frågor angående godsmängd.

- ton  
 fraktdragande vikt (ton)  
 m<sup>3</sup>  
 Annan enhet, nämligen:

.....

Om Ni inte använder verklig vikt i ton, var god ange här en ungefärlig omräkningsfaktor:

1 ton fraktdragande vikt  $\approx$  .....ton (verklig vikt)

1 m<sup>3</sup>  $\approx$  .....ton (verklig vikt)

Annan enhet: .....  $\approx$  .....ton (verklig vikt)

I svaren vill vi helst ha uppgifter gällande år 2002. Om Ni inte kan lämna uppgift för detta år, ange här (eller vid respektive fråga) vilket år som avses. Uppgifter gäller för år: .....

*Tveka inte att kontakta oss om ni har några frågor eller kommentarer:*

Bernt Saxin telefon 031-773 5133

e-post: Bernt.Saxin@handels.gu.se

Catrin Lammgård telefon 031-773 5466

e-post: Catrin.Lammgard@handels.gu.se

Jonas Flodén

telefon 031-773 5131

e-post: Jonas.Floden@handels.gu.se

*Var god besvara varje fråga i enkäten om inte annat anges!*

1. **a) Ungefär hur stor godsmängd skickar Ert arbetsställe årligen? Kryssa för den måttenhet som används.**
- Cirka.....  
 ton  
 fraktdragande vikt, ton  
 m<sup>3</sup>  
 Annan enhet, nämligen: .....
- b) Ansvarar Ert arbetsställe dessutom för distribution från lager i annat land, direkt till kunder i Sverige?**
- Ja, utöver den i fråga 1a angivna volymen distribuerar vi .....(i samma enhet).  
 Denna volym distribueras till kunder i Sverige från följande land / länder: .....
- Nej, vi distribuerar ej från annat land
2. **Hur fördelar sig Ert arbetsställes leveranser på nedanstående produktkategorier? Ange en ungefärlig fördelning i procent av den utgående godsmängden.**
- Ungefär .....% är lagerförda produkter från  
 egen tillverkning  
 andras tillverkning
- Ungefär .....% är produkter tillverkade direkt mot order från  
 egen tillverkning  
 andras tillverkning
- Summa 100 %
3. **Vilken är Ert arbetsställes huvudsakliga verksamhet?**
- Tillverkningsindustri  
 Parti-/grossisthandel  
 Postorder/ e-handel till industri  
 Postorder/ e-handel till konsument  
 Detaljhandel  
 Internleverantör till annan enhet inom företaget  
 Annat, nämligen:.....
4. **Ange vilka kundkategorier (inklusive andra arbetsställen inom företaget) Ert arbetsställe levererar till och deras andel av den utgående godsmängden.**
- |                                    | Andel av utgående godsmängd |
|------------------------------------|-----------------------------|
| Tillverkningsindustri <sup>1</sup> | .....%                      |
| Byggindustri / -installatörer      | .....%                      |
| Partihandel / grossist             | .....%                      |
| Detaljhandel                       | .....%                      |
| Annat, nämligen:.....              | .....%                      |
| Summa                              | 100 %                       |
- <sup>1</sup> Förutom byggindustri / -installatörer
- Kommentar:.....
5. **Vem utför Ert arbetsställes utgående transporter och till vilken andel av utgående godsmängd?**
- Andel av utgående godsmängd*
- |  |        |
|--|--------|
| Vi anlitar speditörer / transportörer <sup>1</sup>     | .....% |
| Egna transporter planeras och utförs i företagets regi | .....% |
| med inhyrd transporttjänst <sup>2</sup>                | .....% |
| med egna (eller leasade) fordon                        | .....% |
| Våra kunder anordnar själva transporter                | .....% |
| Annat sätt:.....                                       | .....% |
| Summa  | 100 %  |
- <sup>1</sup> Även s.k. tredjepartslogistik  
<sup>2</sup> D.v.s. åkeri eller lastbilscentral utför enbart transporten, men samordnar inte transportererna i övrigt
- Kommentar:.....
6. **Denna fråga besvaras om utgående transporter köps in. Vem beslutar om valet av transportör?**
- Företagsledningen / koncernledningen  
 Ledningen för arbetsstället  
 Transportchef /-ansvarig  
 Inköpschef  
 Vår kund  
 Annan, nämligen .....
- Vet ej
- Kommentar:.....
7. **Vem beslutar om valet av transportslag (lastbil, tåg, fartyg, flyg eller en kombination av dessa)?**
- Företagsledningen / koncernledningen  
 Ledningen för arbetsstället  
 Transportchef /-ansvarig  
 Inköpschef  
 Vår speditör / transportör<sup>1</sup>  
 Vår kund  
 Annan, nämligen .....
- Vet ej
- <sup>1</sup> Även s.k. tredjepartslogistik
- Kommentar:.....

8. Denna fråga besvaras om utgående transporter köps in.  
Hur många transportföretag har Ni långsiktiga avtal med (minst ett år) rörande utgående transporter och hur många av dessa innehåller tjänster utöver ren transporttjänst<sup>1</sup>?

Vi har totalt .....st långsiktiga transportavtal varav.....st även med annan logistisk tjänst<sup>1</sup>

Vet ej

Var god specificera även de tre största avtalens längd och andel.

Avtal	Avtalets längd	Andel av utgående godsmängd
Det största	.....år	.....%
Det näst största	.....år	.....%
Det tredje största	.....år	.....%

<sup>1</sup> Lagerhållning, plockning, märkning, prissättning, etc.

9. Fördela viktsumman 100 procent på nedanstående egenskaper i förhållande till deras betydelse för Ert arbetsställe när Ni väljer transportlösning för Era utgående transporter.

Egenskap hos transportlösning	Egenskapens vikt
Priset	.....%
Transporttiden från dörr till dörr	.....%
Tidsprecisionen <sup>1</sup> från dörr till dörr	.....%
Miljöeffektiviteten (representerad av koldioxidutsläpp)	.....%
<b>Summa</b>	<b>100 %</b>

<sup>1</sup> Upphämtning och leverans sker inom överenskommet tidsfönster

10. Vilka lastnings- och lossningsmöjligheter finns vid Ert arbetsställe?

- Industrispår (för tåg)  
 Kaj (för fartyg)  
 Lastbrygga (för lastbil)  
 Terminalyta, t.ex. för uppställning av trailers, containers etc.

Kommentar:.....

11. Ange hur den utgående godsmängden från Ert arbetsställe fördelas på mottagare i nedan angivna geografiska områden och använd gränsstation vid export?

Mottagare i	Andel av utgående godsmängd	Gränsstation (ort) vid export
Sverige	Ungefär .....%	
Norge	Ungefär .....%	Gränsstation: .....
Danmark	Ungefär .....%	Gränsstation: .....
Finland	Ungefär .....%	Gränsstation: .....
Övriga Europa	Ungefär .....%	Gränsstation: .....
Övriga världen	Ungefär .....%	Gränsstation: .....
<b>Summa:</b>	<b>100 %</b>	

Vet ej

Kommentar:.....

12. Denna fråga avser endast godstransporter till kunder i Sverige.  
Uppskatta ungefär fördelningen på transportavstånd av Ert arbetsställes utgående inrikes godsmängd?

Om transporterna går i slinga eller krets, så räkna avståndet till den längst bort belägna kunden.

0 - ca 15 mil.....% av godsmängden

ca 15 - 30 mil.....% av godsmängden

ca 30 - 60 mil.....% av godsmängden

ca 60 - .....% av godsmängden

**Summa:** 100 %

Vet ej fördelningen

Vi har inga godstransporter till kunder i Sverige

Kommentar:.....

13. Vilket eller vilka transportslag används vanligen för Ert arbetsställes utgående transporter? Ange ungefär hur många fordon som hämtar gods vid Ert arbetsställe per vecka.

Transportslag som används dörr-till-dörr	Antal hämtande fordon per vecka
Lastbil <sup>1</sup>	..... st lastbilar
Lastbil + tåg <sup>2</sup>	..... st lastbilar
Lastbil + tåg + fartyg <sup>2</sup>	..... st lastbilar
Lastbil + fartyg <sup>2</sup>	..... st lastbilar
Lastbil + flyg	..... st lastbilar
Tåg <sup>3</sup>	..... st tågvagnar
Fartyg	..... st fartyg

<sup>1</sup> Även då lastbilen delvis fraktas med färja

<sup>2</sup> D.v.s. där enbart lastbäraren (t.ex. semitrailer, container) överförs och transporteras på tåget och / eller fartyget

<sup>3</sup> Utlastning via industrispår

Kommentar:.....

14. Ungefär hur många lastbilar per vecka hämtar minst en fullastad större lastbärare<sup>1</sup>?

Svar: .....st lastbilar per vecka hämtar minst en full lastbärare

Vet ej

<sup>1</sup> D.v.s. växelflak, trailer, ISO-container, släp eller lastbilsflak.

15. Går några av de hämtande lastbilarna i s.k. kretstrafik (t.ex. distributionslinga till återförsäljare)?

Ja, ..... st av alla lastbilar per vecka går i kretstrafik

Nej, inga av våra hämtande lastbilar går i kretstrafik

Vet ej

16. a) Indela Ert gods i nedanstående kategorier. Om visst gods har flera egenskaper, indela då efter den dominerande egenskapen.<sup>1</sup>

Dominerande egenskap	Andel av utgående godsmängd
Normalt gods	Ungefär.....%
Farligt gods	Ungefär.....%
Kyl- o frys, värmegods	Ungefär.....%
Stötkänsligt gods	Ungefär.....%
Skrymmande gods <sup>2</sup>	Ungefär.....%
	Summa: 100 %

Vet ej

<sup>1</sup> Om godset t.ex. är såväl stötkänsligt som skrymmande, välj då den egenskap som dominerar från transportsynpunkt.

<sup>2</sup> Ex. mycket långt eller brett gods som fordrar speciallastbärare.

- b) Hur skickas Ert gods vanligen?

- Pallat
- I mindre specialbehållare, som kan lastas på flak e.d.
- Stående eller liggande direkt på flak eller i skåp
- I bulkbehållare eller i större tank
- På annat sätt, nämligen:.....

Vet ej

- c) Används enhetslastbärare såsom ISO-container, växelflak eller semitrailer anpassad för kombinerad transport?

Ja

Nej

Vet ej

17. Ange ungefärlig ordercykeltid<sup>1</sup> när Era kunder beställer från Ert arbetsställe samt Ert arbetsställes framförhållning<sup>2</sup> när Ni beställer transporter.

Kundkategori	Ordercykeltid <sup>1</sup> antal dygn	Framförhållning	Har ej som kund
Tillverkningsindustri	..... dygn	.....timmar	<input type="checkbox"/>
Byggindustri / -installatör	..... dygn	.....timmar	<input type="checkbox"/>
Partihandel / grossist	..... dygn	.....timmar	<input type="checkbox"/>
Detaljhandel	..... dygn	.....timmar	<input type="checkbox"/>
Annat, nämligen.....	..... dygn	.....timmar	<input type="checkbox"/>

<sup>1</sup> Tidsintervallet mellan Er kunds beställning och mottagande av godset

<sup>2</sup> Hur lång tid före transporten sker beställning alternativt bokning

Kommentar:.....

18. **a) Hur fördelar sig Era kundleveranser procentuellt på transporttid<sup>1</sup> som är överenskommen med Er transportör?**

Godset skall levereras	Andel
samma dag	.....%
under nästa dag före kl 10	.....%
under nästa dag	.....%
senast 2 dagar efter hämtning	.....%
senast 3 dagar efter utlastning	.....%
..... dagar efter utlastning	.....%
<b>Summa</b>	<b>100 %</b>

Ange måttenhet:  % av utgående godsmängd  
 % av antal sändningar

Vet ej fördelningen

<sup>1</sup> D.v.s. tiden från utlastning till avlämning hos kund

**b) Vilka kundkategorier kräver de snabbaste leveranstiderna?**

Tillverkningsindustri<sup>1</sup>  
 Byggindustri / -installatörer  
 Partihandel / grossist  
 Detaljhandel  
 Annan: .....

<sup>1</sup> Förutom byggindustri / - installatörer

Kommentar:.....  
.....  
.....  
.....

19. **a) Skulle Ni kunna boka/beställa Era utgående transporter en dag tidigare än Ni gör idag och vad skulle i så fall krävas?**

Ja, vi skulle kunna boka / beställa minst en dag tidigare än vi gör idag för ungefär.....% av vårt utgående gods.

För detta skulle vi kräva:

att priset på transporten sänktes med ca..... %  
 ingen speciell kompensation eller anledning  
 annat:.....

Nej, bokning / beställning minst en dag tidigare än vi gör idag är omöjligt att göra.

Vet ej

Kommentar:.....

**b) Skulle Era kunder acceptera en dags längre leveranstid och vad skulle i så fall krävas?**

Ja, vi tror att våra kunder skulle acceptera en extra dags leveranstid för ungefär .....% av vårt utgående gods.

För detta skulle de kräva:

att priset på transporten sänktes med ca..... %  
 ingen speciell kompensation eller anledning  
 annat:.....

Nej, längre leveranstid skulle inte accepteras våra kunder.

Vet ej

Kommentar:.....

20. **Frågan avser endast gods som skall levereras dagen efter utlastning från Ert arbetsställe.**

**a) Ange vilka tidsintervall för leverans ("tidsfönster") Ni har avtalat med Era transportörer av utgående gods, samt hur stor andel av detta som faller inom dessa intervall.**

Största överenskomna tidsintervall ("tidsfönster")	Andel
± 0,0 tim	..... %
Max ± 0,5 tim	..... %
Max ± 2,0 tim	..... %
Max ± ..... tim	..... %
Skall levereras under dagen utan tidsrestriktion	..... %
<b>Summa</b>	<b>100 %</b>

Ange måttenhet:  % av utgående godsmängd  
 % av antal sändningar

Vi har inga sådana avtal

**Frågan avser endast gods som skall levereras dagen efter utlastning och besvaras endast om Ni har angivit tidsfönster i fråga 20a.**

**b) Vilka kundkategorier kräver de snävaste tidsintervallen?**

Tillverkningsindustri<sup>1</sup>  
 Byggindustri / installatörer  
 Partihandel / grossist  
 Detaljhandel  
 Annan: .....

<sup>1</sup> Ej byggindustri eller -installatörer

Kommentar:.....  
.....  
.....  
.....

21. **Ungefär hur stor andel av Ert arbetsställes leveranser kommer till kund i överenskommen tid?**

Godsmottagare i	Andel
Sverige	.....%
Norge	.....%
Danmark	.....%
Finland	.....%
Övriga Europa	.....%

Vet ej

Kommentar: .....

.....

.....

.....

.....

22. **a) Var god ange ungefärlig procentuell fördelning av utleveranserna över veckan (i genomsnitt).**

Veckodag	Andel
Måndag	.....%
Tisdag	.....%
Onsdag	.....%
Torsdag	.....%
Fredag	.....%
Lördag	.....%
Söndag	.....%
<i>Summa</i>	<i>100%</i>

Vet ej

Ange måttenhet:

% av godsmängden

% av antal sändningar

Kommentar: .....

.....

**b) Var god ange ungefärlig procentuell fördelning av utleveranserna över dagen (i genomsnitt).**

Klockslog	Andel
Före 06	.....%
kl. 06-10	.....%
kl. 10-14	.....%
kl. 14-18	.....%
Efter 18	.....%
<i>Summa</i>	<i>100%</i>

Vet ej

Ange måttenhet:

% av godsmängden

% av antal sändningar

Kommentar: .....

.....

23. **a) Ungefär hur stor andel av Ert arbetsställes utgående godsmängd blev transportskadad? Ange i så många enheter som möjligt.**

Ungefär.....% av utgående godsmängd

Ungefär.....% av utgående godsvärde

Ungefär.....% av antalet sändningar

Vet ej

Kommentar: .....

.....

.....

.....

.....

**b) Ange vilket eller vilka transportslag som brukar ge mest skador? Var god besvara frågan även om Ni bara använder ett transportslag.**

Vi använder bara ett transportslag.

Lastbil<sup>1</sup>

Lastbil + tåg<sup>2</sup>

Lastbil + tåg + fartyg<sup>2</sup>

Lastbil + fartyg<sup>2</sup>

Lastbil + flyg

Tåg<sup>3</sup>

Fartyg

Vet ej

<sup>1</sup> Även då lastbilen delvis fraktas med färja

<sup>2</sup> D.v.s. där enbart lastbäraren (t.ex. semitrailer, container) transporteras på tåget och / eller fartyget

<sup>3</sup> Utlastning via industrispår

## 24. Ange vilken vikt nedanstående egenskaper hos transportörer har för Ert arbetsställes val av transportör, samt i vilken grad Er nuvarande huvudtransportör har dessa egenskaper.

Ange Er uppfattning med ett kryss på varje 7-gradig skala nedan, där 1 = mycket liten vikt / i mycket låg grad och 7 = mycket stor vikt / i mycket hög grad.

Egenskapens vikt för val av transportör							Egenskap	I vilken grad har Er transportör denna egenskap?								
Mycket liten vikt			Mycket stor vikt					I mycket låg grad			I mycket hög grad					
←	1	2	3	4	5	6	7	→	1	2	3	4	5	6	7	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Transportören...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...täcker in vårt geografiska marknadsområde tillräckligt väl
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har ett bra IT-stödssystem för beställning från oss (t.ex. EDI, internetbeställning)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har ett bra IT-stödssystem för att följa godsets väg (t.ex. track and trace)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har ett brett sortiment av kompletterande logistik-tjänster (t.ex. lagerhållning, emballering)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...vet hur vårt gods skall hanteras bla för att undvika godsskador
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...är kvalitetscertifierad, t.ex. ISO 9000
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har bra rutiner för dokumenthantering
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har säkerhetsrutiner mot stölder och svinn
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan erbjuda kundanpassade transportlösningar
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...är lättillgänglig vid förfrågan och bokning
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...är lättillgänglig vid uppföljning av order
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har många schemalagda avgångar
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan anpassa sig till stora volymvariationer
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan åta sig leveranser med kort varsel ("brandårsutryckningar")
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...håller överenskomna tider
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...håller sina utfästelser
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har väl fungerande rutiner för avvikelserapportering
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har trevligt bemötande vid hämtning och leverans
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...håller en jämn kvalitetsnivå
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har anlitats av oss tidigare
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har ett gott rykte
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...erbjuder ett av de lägsta priserna
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...ger oss tillgång till lösa lastbärare (t.ex. växelflak, semitrailers) som vi kan lasta innan hämtning
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan erbjuda de transportsätt (lastbil, tåg, båt, flyg eller kombination av dessa) som vi önskar
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan samordna våra in- och utgående transporter
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...erbjuder samleveranser med andra företag för att minska tomtransporter
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan erbjuda godstransporter på tåg
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har hög fyllnadsgrad av gods (lastfaktor)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...använder andra bränslen än diesel, t.ex. biobränslen, gas
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...använder lastbilar med hög miljöklass
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...kan erbjuda kombinerade godstransporter lastbil-tåg
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...är miljöcertifierad, t.ex. ISO 14001
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...har miljöeffektiva transporter



25.	<p><b>a) Har Ert arbetsställe infört eller håller på att införa något miljöledningssystem?</b></p> <p><input type="checkbox"/> Ja, har införts  <input type="checkbox"/> Håller på att införas  <input type="checkbox"/> Nej  <input type="checkbox"/> Vet ej</p>	<p><i>Besvaras om miljöledningssystem finns eller håller på att införas.</i></p> <p><b>b) Vilket miljöledningssystem avses?</b></p> <p><input type="checkbox"/> ISO 14001  <input type="checkbox"/> EMAS  <input type="checkbox"/> Annat:.....</p>
26.	<p><b>a) Finns det eller håller ni på att utforma någon miljöpolicy på Ert arbetsställe idag?</b></p> <p><input type="checkbox"/> Ja, det finns  <input type="checkbox"/> Nej, det finns inte  <input type="checkbox"/> Vi håller på att utforma  <input type="checkbox"/> Vet ej</p>	<p><i>Besvaras om en miljöpolicy finns eller håller på att utformas.</i></p> <p><b>b) Sammanfatta kort arbetsställets (företagets) miljöpolicy när det gäller transporter.</b></p> <p>.....  .....  .....  .....</p>
	<p><i>Besvaras om en miljöpolicy finns eller håller på att utformas.</i></p> <p><b>c) I vilken utsträckning påverkar Ert arbetsställes miljöpolicy transportuppläggen idag?</b></p> <p><input type="checkbox"/> I mycket stor utsträckning  <input type="checkbox"/> I stor utsträckning  <input type="checkbox"/> I ganska stor utsträckning  <input type="checkbox"/> I varken stor eller liten utsträckning  <input type="checkbox"/> I ganska liten utsträckning  <input type="checkbox"/> I liten utsträckning  <input type="checkbox"/> I mycket liten utsträckning</p>	<p><i>Besvaras om en miljöpolicy finns eller håller på att utformas.</i></p> <p><b>d) Om miljöpolicyen påverkar, beskriv på vilket sätt.</b></p> <p>.....  .....  .....  .....</p>
27.	<p><b>Ställer Era kunder några miljökrav som påverkar Ert arbetsställes transportmedelsval?</b></p> <p><i>För Era inkommande transporter:</i></p> <p><input type="checkbox"/> Ja  <input type="checkbox"/> Nej  <input type="checkbox"/> Vet ej</p> <p>Om ja, vilka är Era kunders krav och hur påverkar de?  .....  .....</p> <p><i>För Era utgående transporter:</i></p> <p><input type="checkbox"/> Ja  <input type="checkbox"/> Nej  <input type="checkbox"/> Vet ej</p> <p>Om ja, vilka är Era kunders krav och hur påverkar de?  .....  .....</p>	<p><b>28. Ställer Ert eget företag några konkreta miljökrav på Era transporter?</b></p> <p><i>För Era inkommande transporter:</i></p> <p><input type="checkbox"/> Ja  <input type="checkbox"/> Nej  <input type="checkbox"/> Vet ej</p> <p>Om ja, vilka är Ert företags krav och hur påverkar de?  .....  .....</p> <p><i>För Era utgående transporter:</i></p> <p><input type="checkbox"/> Ja  <input type="checkbox"/> Nej  <input type="checkbox"/> Vet ej</p> <p>Om ja, vilka är Ert företags krav och hur påverkar de?  .....  .....</p>
29.	<p><b>Vilken miljöpåverkan, som Era transporter ger upphov till, anser Ni vara den mest negativa?</b></p> <p>.....  .....</p>	

**30. Ange vilken betydelse Ni tror att nedanstående åtgärder skulle ha för att minska Era transporters miljöpåverkan, samt vilken möjlighet Ni tror finns att genomföra åtgärden.**

Ange Er uppfattning om åtgärdens betydelse/möjlighet att genomföras med ett kryss på varje 7-gradig skala nedan, där 1 = mycket liten betydelse / mycket liten möjlighet och 7 = mycket stor betydelse / mycket stor möjlighet.

Betydelse för att minska miljöpåverkan		Åtgärd	Möjlighet finns att genomföra åtgärden												
Mycket liten ←	Mycket stor →		Mycket liten ←	Mycket stor →											
1	2	3	4	5	6	7	1	2	3	4	5	6	7	Redan genomfört	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tillsätta en miljöchef/miljöavdelning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Mer utbildning i miljöfrågor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Bli miljöcertifierade, t.ex. ISO 14001	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Publicera miljöredovisningar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ökat stöd för miljöprioriteringar från ledningen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Införa en miljöpolicy i vårt företag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ökat samarbete med den miljöansvarige i vårt företag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ökat samarbete i miljöfrågor med transportör/speditör	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ökat samarbete i miljöfrågor med kunder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ökat samarbete i miljöfrågor med leverantörer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ställa hårdare miljökrav på våra leverantörers transporter till oss	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Annan insats, nämligen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mycket liten ←	Nedanstående frågor berör endast Era utgående transporter		Åtgärd		Mycket liten ←	Mycket stor →									
1	2	3	4	5	6	7	1	2	3	4	5	6	7		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Använda lastbilar med hög miljöklass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ställa hårdare miljökrav på våra utgående transporter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Använda andra bränslen än diesel, t.ex. biobränslen, gas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minska tomtransporterna / öka returtransporterna av gods genom t.ex. samleveranser med andra företag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Öka fyllnadsgraden av gods (lastfaktorn)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Transportera mer av vårt gods på tåg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Använda mer kombinerade godstransporter lastbil-tåg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Annan insats, nämligen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Kommentar:.....  
.....

*Tack för din medverkan!*

*Var god lägg den ifyllda enkäten i det bifogade portofria svarskuvertet och returnera det till oss.  
Adress: Bernt Saxin, Handelshögskolan vid Göteborgs universitet, Box 610, 405 30 Göteborg.*

## Appendix 4: Survey question 24 for factor analysis (English)

The respondent was asked to state what weight each of the qualities below has when their local unit selects transport provider (on a scale from 1 to 7).

### The transport provider...

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- 1 ...covers our market geographically in a sufficient manner.
  - 2 ...has a good IT support system for receiving our orders (e.g. EDI, Internet)
  - 3 ...has a good IT support system for following the freight (e.g. track and trace)
  - 4 ...has a wide range of complementary logistics services
  - 5 ...knows how to handle our freight in order to avoid damages
  
  - 6 ...has a quality certification e.g. ISO 9000
  - 7 ...has good routines for handling documents
  - 8 ...has safety routines against theft and loss
  - 9 ...can offer custom-made transport solutions
  - 10 ...is easily accessible regarding inquiries and bookings
  - 11 ...is easily accessible regarding follow-up of transports
  
  - 12 ...has many scheduled departures
  - 13 ...can adjust to large variations in volumes
  - 14 ...can make deliveries at short notice
  - 15 ...keep to time agreed upon
  - 16 ...fulfills its commitments
  
  - 17 ...has well functioning routines for reporting deviations
  - 18 ...meets with kind treatment at collection and delivery of freight
  - 19 ...has consistent quality
  - 20 ...has been engaged by us previously
  - 21 ...has a good reputation
  
  - 22 ...offers one of the lowest prices
  - 23 ...gives us access to detachable load-carriers (e.g. swap-bodies, semi trailers)
  - 24 ...can offer transport modes we desire (truck, train, boat, flight or combined)
  - 25 ...can coordinate our inbound and outbound transports
  - 26 ...offers coordinated shared deliveries with other companies in order to reduce empty load transports
  
  - 27 ...can offer freight transports on rail
  - 28 ...has a high loading factor of freight
  - 29 ...uses other fuels than diesel. e.g. bi-fuel and gas
  - 30 ...uses trucks in high environmental classes
  - 31 ...can offer intermodal truck-train transports
  - 32 ...is certified by an Environmental Management System e.g. ISO 14001
  - 33 ...has environmentally efficient transports
-

## Appendix 5: Survey results on priorities per stratum, on-time deliveries and damaged goods

An additional analysis was done based on the ranking per strata instead (see Table A5.1). Here, all companies, regardless of size, also have the same six top priorities when choosing a transport provider, except for in two cases where lower-ranked factors were at sixth place (marked “\*” in Table A5.1).

**Table A5.1 The Top 6 qualities (out of 33) ranked highest in importance when local units select transport providers, divided by strata**

# Stratified Total	Small Manufacturing	Small wholesale	Medium Manufacturing	Medium wholesale	Large Manufacturing	Large wholesale
1 Fulfills commitments	Performs transports in time	Fulfills commitments	Fulfills commitments	Performs transports in time	Performs transports in time/ Fulfills commitments	Performs transports in time
2 Performs transports in time	Easily accessible (inquiries and bookings)	Geographi ccoverage	Performs transports in time	Fulfills commit-ments		Fulfills commit-ments
3 Geographi ccoverage	Fulfills commit-ments	Performs transports in time	Easily accessible (inquiries and bookings)	Geographi ccoverage	Easily accessible ( inquiries and bookings)	Geographi ccoverage
4 Easily accessible (inquiries and bookings)	Geographi ccoverage	Easily accessible (inquiries and bookings)	Know-how of handling goods	Easily accessible (inquiries and bookings)	Know-how of handling goods	Consistent quality
5 Consistent quality	Consistent quality	Consistent quality	Consistent quality	Know-how of handling goods	Consistent quality	Know-how of handling goods
6 Know-how of handling goods	Easily accessible (follow-up of transports)	*Custom made transport solutions	*Can adjust to large variations in volumes	Consistent quality	Geographi ccoverage	Easily accessible (inquiries and bookings)

All manufacturing and wholesale companies ranked among the top three priorities: that the transport provider “performs in time agreed upon” and “fulfills its commitments”. It appears that the wholesale companies give higher ranking to geographical coverage than the manufacturing companies do. Medium-sized and large manufacturers ranked accessibility of the transport provider (easy to get information and to book) after the reliability items. These companies also rank skill of goods handling (overall rank nr 6) after accessibility, denoting their concern to avoid goods damages and disturbances in the flow. A stable quality level (“consistent quality”) that follows in ranking could indicate a similar concern. Fluctuations in service quality can disturb the production or business processes and it is therefore vital that the deliveries are predictable.

The second most important priority when choosing a transport provider was that the transport provider performs transports in the time agreed upon. Therefore it is interesting to look closer at the deliveries and if these fail to be on time. Although this could imply that arrive earlier than agreed upon, it can be assumed that the problem is greater with late deliveries. The respondents were asked what share of the deliveries arrives to the customer on time in a selection of different countries/regions. The stratified averages to each region are presented in the Table A5.2.

**Table A5.2 Average company proportion of freight transports that arrive on time agreed upon (%).**

Freight receivers in:	n	Share of freight transports %
Sweden	457	92.6 +/-1.2
Norway	217	93.7 +/-2.6
Denmark	210	94.1 +/-2.0
Finland	181	94.0 +/-2.8
Rest of Europe	234	91.5 +/-3.8

Note that figures in Table A5.2 are average company shares, which do not consider the volume of goods. The highest shares of punctual deliveries were to the neighboring countries of Denmark, Finland, and Norway (around 94%) and the lowest (91.5%) to the rest of Europe. Domestic deliveries in Sweden had a share of 92.6%, which may seem

low in comparison to the other destinations. An explanation is the stratified mean used, where shares for the smaller companies outnumber the medium- and large-sized companies. In these strata the share of transports on-time was much lower but is not shown in this simplified table. The share for Sweden is instead 96.3%, when it is weighted against freight volumes.

Dimensions close to goods quality can be found on the fourth and sixth place of the ranking list of priorities; “keeps a consistent quality level” and “knows how to handle our freight in order to avoid goods damages”. Are damaged goods a problem among shippers today? Table A5.3 shows the average share of freight volume that is damaged.

**Table A5.3 Proportion of freight volume transported that is damaged (%).**

Damaged goods	n	Share for average shipper %
Of freight volumes	277	1.65 +/-0.57
Of freight value	108	0.64 +/-0.33
Of number of shipments	161	0.95 +/-0.44

It is only 1.65% of all freight volumes, or less than 1% (0.95) of the number of shipments that is damaged. Moreover, there were 37 additional respondents stating that the share was “very small”, “immeasurable”, “hardly ever occurs” etc., but they are not included in Table A5.3.

## Appendix 6: Additional gap analysis of environmental measures (Wilcoxon Signed Rank Test)

In addition to the paired samples t-test, a Wilcoxon Signed Rank Test was conducted. The null hypothesis is that two related medians are the same, so that the paired medians between the importance and the possibilities for implementation of measures were compared. Instead of comparing means, the Wilcoxon converts scores to ranks and compares them. The differences in the paired observations are calculated, then they are ranked from smallest to largest by absolute value. This is a non-parametric alternative, or distribution free test, to the parametric t-tests. However, these results of the Wilcoxon Signed Ranks test showed that the same groups of companies as in the t-tests had significant differences between the importance and the possibility of implementation (see Table A6.1).

**Table A6.1 Wilcoxon Signed Ranks Test between rated importance and possibility of implementation of each factor among companies with more than 100 employees**

Company		Factor 1: Internal organiza- tional aspects	Factor 2: External co- operation	Factor 3: Outbound transports	Factor 4: Modal aspects	Factor 5: Volume (Loading)
<b>Large wholesale</b> (n=53-81)	Z	-2.883*	-3.655	-4.145	-6.258	-5.488
	Sign.	.004	.000	.000	.000	.000
<b>Large manufacturing</b> (n=69-105)	Z	-4.894*	-2.909	-5.716	-6.391	-5.417
	Sign.	.000	.004	.000	.000	.000
<b>Medium manufacturing</b> (n=96-150)	Z	-2.870*	-4.057	-7.665	-7.806	-6.439
	Sign.	.004	.000	.000	.000	.000

\* Based on negative ranks

## Appendix 7: Specification of shippers' requirements per stratum

The conceptual model is used in the Section 9.4.1 for the Specification of shippers' requirements. A number of indicators from the survey results sections (Chapters 6-8) were selected from the three contexts; the logistical context, the environmental management context and the purchasing context (see Table 9.1 or Table A7:1 below). The target population and the strata were categorized along indicators. This section will explain more in detail how the categorization was done and how the limits for the categories for each indicator were defined.

The means of all strata were to be compared and a categorization could have been done through personal judgment. This was not chosen but instead the percentiles of each indicator were calculated. These percentiles then defined the limits for the ordinal categories used (XS, S, M, L, XL) of each indicator. This permits more transparency of these results and allows others to repeat and compare the results. It can be considered as a more objective way of finding the limits for the categories, than through personal judgment. However, the categorization should not be considered as an exact science, but rather a 'best judgment' where the percentiles facilitate to use the categorization as a benchmark. The objective was to draw conclusions about all companies in Sweden having freight transports exceeding 150 km (the target population), not only about these included in the survey sample. The percentiles were therefore based on sample estimates of population characteristics. All observations were weighted in relation to their probability for selection in the total population, depending on the size of the stratum the company belongs to ( $N_h$ ) and on how many respondents had answered the question in that stratum ( $n_h$ ). Different principles were used for (1) Interval and ratio scaled variables, (2) Binary scales, nominal variables, and (3) Special treatments.

### **(1) Interval and ratio scaled variables**

First, all numeric data ( $X_i$ ) that the respondents had provided on an indicator were ranked. Let  $i$  denote rank number  $i$  for sample observation  $X_i$  sorted in increasing order,  $1 \leq i \leq n$ , with  $n=7832$  (the size of the target population). Secondly, the probabilities for selection ( $f_i = n_h / N_h$ ) were calculated. Thirdly, the weighting ratios were calculated ( $V_i = 1/f_i$ ), which were then cumulated:

$$\text{Cum}_i = \sum_{j=1}^i v_j .$$



Finally, a relative cumulation was done ( $CUM_i = Cum_i / Cum_n$ ). After this procedure, the percentiles were calculated i.e. the percentile  $X_p$  ( $0 \leq P \leq 1$ ) is the  $X_i$  of which  $CUM_i = P$ . The categories were then defined as intervals between percentiles.

## **(2) Binary scaled, nominal variables**

In this case, proportions of respondents having a certain property were used as indicators for groups i.e. strata. The percentiles were computed from the sampling distributions of the stratified proportions  $P_{st}$  assuming these to follow the normal probability distribution. This assumption is reasonable considering the sample size.

## **(3) Special treatments**

There were mainly two types of cases for which special treatments had to be made. Firstly, when there were no available data per company since these were based on estimations on the total population. However, there were data on the stratum level. Secondly, there were data measured on an interval scale (their means) based on discrete variables (a value on an seven-point attitude scale). These special treatments will be discussed further on along with the percentiles chosen.

Table A7.1 is an extension from Table 9.1, with the list of indicators used but also including additional information on each indicator; the definition of the limits for the categories, the min-max values for strata as well as for individual cases (when possible), and the response rate ( $n$ ). There were 16 indicators used for the categorization (Indicators 1-16). In addition, there were four **variables providing background information** belonging to two groups; Characteristics of the market (including 'Estimated total freight' and 'Number of shippers') and 'Characteristics of supplier contracts' (including 'Proportion of shippers contracting transport providers' and 'Number of contracts with transport providers'.) These were categorized too, except for one ('Estimated total freight'). However, these four variables did not influence the summarized categories 'Potential for intermodal road-rail transports' and 'Priority of price'.

**Table A7.1 List of indicators used with explanations, limits for categories, strata min-max values and response rate for each question (n)**

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**Logistical context:**

- 1. Average weight/year;** average weight (ton) per company in stratum and year [XS=0-0.8, S=0.9-9.9, M=10-44, L=45-184, XL>185], Case min-max: 0,0005-2700, Strata min-max: 2-200.  $P_{0.25}=0.85$ ,  $P_{0.50}=7$ ,  $P_{0.55}=9.9$ ,  $P_{0.75}=45$ ,  $P_{0.90}=185$ .  $n=530$ .
- 2. Proportion of total freight;** the stratum's share (%) of the total estimated freight sent per year [XS=0-2.9, S=3-7.9, M=8-15.9, L=16-21, XL>21], Strata min-max: 7-37
- 3. Proportion of total freight exported;** the stratum's share (%) of the total estimated freight exported per year [XS=0-2.9, S=3-4.9, M=5-10.9, L=11-14, XL>14], Strata min-max: 2.5-54.4
- 4. Proportion of total domestic freight;** the stratum's share (%) of the total estimated freight sent within Sweden per year [XS=0-4.9, S=5-10.9, M=11-16.9, L=17-22.9, XL=>23], Strata min-max: 10.0-24.4
- 5. Proportion of domestic freight sent >300 km;** the estimated average share of freight (%) sent longer than 300 km within Sweden in the stratum [XS=0-10, S=11-35, M=36-40, L=41-65, XL>65]. Case min-max: 0-100, Strata min-max: 29-5.  $P_{0.20}=10$ ,  $P_{0.45}=35$ ,  $P_{0.55}=40$ ,  $P_{0.80}>65$ .  $n=440$ .
- 6. Proportion of shippers using truck/train/(ship);** the share of shippers (%) in the stratum that uses intermodal truck/train/(ship) transports [XS=0-2.2, S=2.3-2.9, M=3.0-4.4, L=4.5-5.0, XL>5.0], Strata min-max: 0-19.8.  $P_{0.05}=2.23$ ,  $P_{0.20}=2.93$ ,  $P_{0.80}=4.41$ ,  $P_{0.95}=5.11$ .  $n=536$ .

**Market characteristics:**

**Estimated total freight:** sent per year measured in million ton equivalents, Strata min-max: 8-44.  $n=7832$ .

**Number of shippers;** in the stratum belonging to the target population i.e. having transports exceeding 150 km [S<299, M=300-1499, L=1500-2499, XL>2500], Strata min-max: 131-3385.  $n=7832$ .

**Environmental management context:**

- 7. Frequency of CEP implementation;** share of shippers (%) that has implemented an Corporate Environmental Policy [XS=0-41.5, S=41.6-44.7, M=44.8-51.3, L=51.4-54.5, XL>54.6]. Strata min-max: 37-92.  $P_{0.05}=41.5$ ,  $P_{0.20}=44.7$ ,  $P_{0.80}=51.3$ ,  $P_{0.95}=54.5$ .  $n=492$ .
  - 8. Frequency of EMS implementation;** share of shippers (%) that has implemented an Environmental Management System [XS=0-20.9, S=21-23.4, M=23.5-28.6, L=28.7-31, XL>31.1]. Strata min-max: 16-75.  $P_{0.05}=21.0$ ,  $P_{0.20}=23.4$ ,  $P_{0.80}=28.6$ ,  $P_{0.95}=31.1$ .  $n=513$ .
  - 9. Importance of CEP on transport planning;** to what extent the Corporate Environmental Policy affected the transport planning [XS=0-2.5, S=2.6-3.5, M=3.6-4.5, L=4.6-5.5, XL=5.6-7], Case min-max: 1-7, Strata min-max: 3.3-4.5.  $P_{0.10}=2$ ,  $P_{0.30}=3/4$ ,  $P_{0.50}=4$ ,  $P_{0.70}=5$ ,  $P_{0.90}=6$ .  $n=393$ .
  - 10. Existence of customer demands;** share of shippers (%) that receive environmental demands from customers affecting the choice of transport mode regarding the
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outbound transports [XS=0-6.9, S=7.0-8.7, M=8.8-12.4, L=12.5-14.2, XL>14.3].  
Strata min-max: 7-38.  $P_{0.05}=6.9$ ,  $P_{0.20}=8.7$ ,  $P_{0.80}=12.4$ ,  $P_{0.95}=14.2$ .  $n=464$ .

11. **Existence of internal demands;** share of shippers (%) that receive environmental demands from the own company affecting the choice of transport mode regarding the outbound transports [XS=0-17.3, S=17.4-19.6, M=19.7-24.4, L=24.5-26.7, XL>26.8]. Strata min-max: 12-67.  $P_{0.05}=17.3$ ,  $P_{0.20}=19.6$ ,  $P_{0.80}=24.4$ ,  $P_{0.95}=26.7$ .  $n=478$ .
12. **Importance of environmental efficiency in trade-off;** attributed importance of environmental efficiency in the trade-off with price, transport time, and on-time delivery when selecting transport solution [XS=0, S=1-4.9, M=5-9.9, L=10-14.9, XL>15-], Case min-max: 0-80, Strata min-max: 3-10.  $P_{0.40}=0/1$ ,  $P_{0.45}=5$ ,  $P_{0.55}=5$ ,  $P_{0.60}=10$ ,  $P_{0.85}=15$ .  $n=531$ .
13. **Importance of the factor Environmental aspects when selecting transport provider;** average value of the attributed importance to the factor "Environmental aspects" in the factor analysis [XS=0-2.5, S=2.6-3.9, M=4.0-5.1, L=5.2-5.7, XL≥5.8], Case min-max: 1-7, Strata min-max: 3.95-5.20.  $P_{0.10}=2.6$ ,  $P_{0.30}=4.0$ ,  $P_{0.60}=5.2$ ,  $P_{0.80}=5.8$ .  $n=495$ .

### **Purchasing context:**

14. **Importance of price in trade-off;** attributed importance of price in trade-off with transport time, on-time delivery and environmental efficiency when selecting transport solution [XS=0-24, S=25-49, M=50-59, L=60-79, XL=80-100], Case min-max: 0-100, Strata min-max: 46-61.  $P_{0.15}=25$ ,  $P_{0.45}=50$ ,  $P_{0.60}=60$ ,  $P_{0.85}=80$ .  $n=531$ .
15. **Environment/price ratio;** ratio between environmental efficiency and price from the trade-off question. The higher ratio, the less price sensitive is the company in relation to environmental aspects [XS<0.025, S=0.026-0.110, M=0.111-0.167, L=0.168-0.25, XL>0.251], Case min-max: 0-4, Strata min-max: 0.07-0.33.  $P_{0.40}=0.025$ ,  $P_{0.50}=0.111$ ,  $P_{0.60}=0.167$ ,  $P_{0.70}=0.25$ .  $n=525$ .
16. **Importance of 'Price' when selecting transport provider;** average value of the attributed importance to the factor/item "Price" in the factor analysis [XS=0-2.9, S=3-3.9, M=4-4.9, L=5-6.9, XL≥6.9], Case min-max: 2-7, Strata min-max: 5.41-5.76.  $P_{0.05}=3/(4)$ ,  $P_{0.10}=4$ ,  $P_{0.20}=5$ ,  $P_{0.50}=6$ ,  $P_{0.75}=7$ .  $n=524$ .

### ***Characteristics of supplier contracts:***

- Proportion of shippers contracting transport providers;** share of shippers (%) that contract transport providers [XS=<93.5, S=93.5-94.3, M=94.4-96.3, L=96.4-97.1, XL>97.1], Strata min-max: 77-100.  $P_{0.05}=93.4$ ,  $P_{0.20}=94.3$ ,  $P_{0.80}=96.3$ ,  $P_{0.95}=97.2$ .  $n=556$ .
- Number of contracts with transport providers;** average number of long-term transport contracts in use [XS=0-1.9, S=2-2.9, M=3-3.9, L=4-9, XL>9], Case min-max: 1-60, Strata min-max: 2.5-11.0.  $P_{0.20}=2$ ,  $P_{0.40}=3$ ,  $P_{0.60}=4$ ,  $P_{0.80}=9$ .  $n=518$ .
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*The indicators* were mainly measured on a nominal or an interval scale. There were some differences between the indicators, which had to be dealt with in the process of finding and choosing percentiles. This will be discussed next.

The first group of indicators is the interval or ratio scaled variables. The percentiles chosen, that defined the limits of categories, for these corresponding indicators (indicators 1, 5, 12, 14, 15, and the variable ‘Number of contracts with transport providers’) were selected based on where the natural breakpoints appeared in the sample and thus differed somewhat between indicators. It can be noted that since the percentiles are based on relative values, this signifies that two indicators originating from the same survey question can have different categorization scales. An example is the indicators 12 (‘Importance of environmental efficiency in trade-off’) and 14 (‘Importance of price in trade-off’) that both were based on the same survey question where the respondents distributed 100% according to the importance of price, transport time, on-time delivery and environmental efficiency (see Figure 6.1 and survey question 9 in Appendix 3).

The second group of indicators were the nominal data with binary outcomes (indicators 6, 7, 8, 10 and 11 but also the variable ‘Proportion of shippers contracting transport providers’), where the probability for each stratum could be calculated. This was possible since it was known whether each respondent had the characteristic i.e. had answered yes, and therefore it was possible to identify those that did not have the characteristic. As the sample was large, the normal distribution was used to approximate the sampling distribution of the sample proportions. The percentiles used in defining the limits for the categories were:  $P_{0.05}$ ,  $P_{0.20}$ ,  $P_{0.80}$  and  $P_{0.95}$ .

The third group of indicators was those that did not fall into the two types already mentioned. In these cases, special treatments had to be made. Mainly two types will be mentioned here.

(1) A few variables were continuous data that were based on estimations of the total freight market (indicators 2-4). There were no data available per company; thus the categorization was only possible on the stratum level. This lack of information had to be dealt with. A stratified average of the proportions (%) of the six strata was calculated (marked with \* in the column All). This was done only in order to find an average, but it is not the same as calculating the proportion of the total estimated freight. The latter is the more correct way of finding a ‘real’ proportion for the total market and these figures are seen in Figure A7.1. After this, the categorization was done based on breakpoints that were set in relation to the stratified mean of proportions and by personal judgment.

(2) Another group of indicators was based on survey questions where the respondents were asked to grade the importance with a seven-point attitude scale<sup>1</sup> (indicators 9, 13 and 16). Two of the indicators (9 and 13) were measured on an interval scale (their means) based on discrete variables (1-7). The percentiles chosen, that defined the limits of categories, were selected based on where the breakpoints appeared in the sample and thus differed somewhat. This was judged to be better than to choose a predetermined percentile that cut off an obtained value in the middle. The stratified means were categorized as being at a medium value. However in indicator 16, there were small differences between the strata and all strata had rated Price to be of high importance (5.4 to 5.8 in mean on the 1-7 scale). Therefore, the percentiles chosen that set the limits for the categories had to be reasonably in accordance with the original scale, and not only based on the relative distribution among companies. This theoretical consideration resulted in that all strata fell into the category Large (the only indicator where the total market did not fall into the category Medium).

In addition, the variable ‘Number of shippers’ was categorized on personal judgment since the raw data did not provide exact information of each company.

An over-view of the categorization of indicators for the total market and the six strata was presented in Table 9.2. This is shown once again in Table A7:2, but also including the raw data for the categorization for each stratum and for the whole population (‘All’). Once again, the order of columns was chosen for the sake of clarity; with mainly increasing category values except for ‘All’.

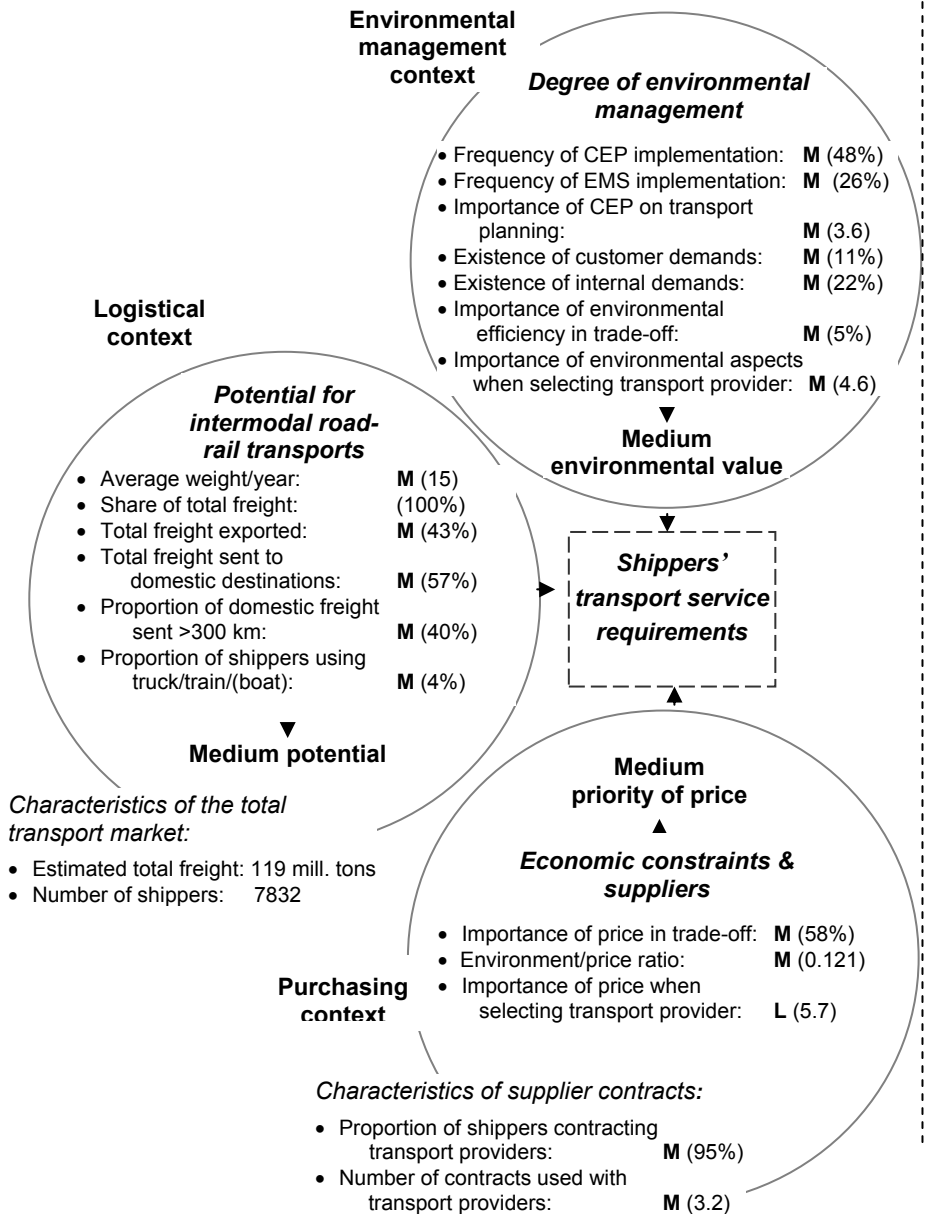
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<sup>1</sup> For example, see survey question 24 in Appendix 4.

**Table A7.2 Categories of indicators, based on their values (in brackets)**

<b>Indicator</b>	<b>Small wholes.</b>	<b>Medium wholes.</b>	<b>Small manuf.</b>	<b>Large wholes.</b>	<b>Medium manuf.</b>	<b>Large manuf.</b>	<b>All</b>
<b><u>Logistical context:</u></b>							
Average weight/year (ton)	S (2)	S (8)	S (8)	L (98)	M (36)	XL (200)	M (15)
Proportion of total freight (%)	S (7)	S (7)	M (14)	M (11)	L (24)	XL (37)	M (12)*
Proportion of total freight exported (%)	XS (2.5)	S (3.2)	M (8.8)	S (4.5)	XL (26.6)	XL (54.4)	M (8.3)*
Proportion of total domestic freight (%)	S (10.0)	S (10.0)	L (18.5)	M (15.5)	L (21.6)	XL (24.4)	M (14.1)*
Proportion of domestic freight sent >300 km (%)	M (36)	L (41)	M (33)	S (29)	L (44)	XL (51)	M (37)*
Proportion of shippers using truck/train/(ship) (%)	XS (0)	XL (5.8)	M (3.6)	M (3.3)	XL (12.2)	XL (19.8)	M (3.7)
<b><u>Potential for intermodal road-rail trsp.</u></b>	<b>S</b>	<b>S/M</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>XL</b>	<b>M</b>
<b><u>Market characteristics:</u></b>							
Estimated total freight (mill. ton)	8	8	17	13	28	44	119
Number of shippers	XL(3385)	M (1063)	L (2244)	S (131)	M (787)	S (222)	7832
<b><u>Environmental management context</u></b>							
Frequency of CEP implementation (%)	XS (37)	M (48)	M (48)	XL (74)	XL (77)	XL (92)	M (48)
Frequency of EMS implementation (%)	XS (16)	M (25)	M (24)	XL (55)	XL (61)	XL (75)	M (26)
Imp. of CEP on transport planning (1-7)	S (3.3)	M (4.5)	S (3.3)	M (4.2)	M (4.1)	M (4.4)	M (3.6)
Existence of customer demands (%)	S (7)	XL (16)	S (7)	XL (38)	XL (20)	XL (26)	M (11)
Existence of internal demands (%)	XS (12)	XL (27)	M (20)	XL (54)	XL (45)	XL (67)	M (22)
Imp. of environmental efficiency in trade-off (%)	S (3)	M (5)	M (5)	M (8)	M (7)	L (10)	M (5)
Imp. of 'Environmental aspects' when selecting trsp.provider (1-7)	S (3.95)	S (4.32)	S (4.00)	M (4.90)	M (4.52)	L (5.20)	M (4.12)
<b><u>Environmental need</u></b>	<b>S</b>	<b>M</b>	<b>S/M</b>	<b>L</b>	<b>L</b>	<b>XL</b>	<b>M</b>
<b><u>Purchasing context:</u></b>							
Imp. of price in trade-off (%)	L (61)	S (49)	M (59)	S (46)	M (54)	S (48)	M (58)
Environment/price ratio	S (.073)	M (.152)	M (.121)	XL (.260)	L (.209)	XL (.327)	M (.121)
Imp. of 'Price' when selecting trsp. prov.(1-7).	L (5.60)	L (5.75)	L (5.73)	L (5.41)	L (5.76)	L (5.69)	L (5.67)
<b><u>Priority of Price</u></b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>
<b><u>Characteristics of supplier contracts:</u></b>							
Proportion of shippers contracting trsp.prov. (%)	XL (100)	M (96.2)	XS (91.2)	XS (76.9)	XS (91.6)	XS (89.9)	M (95.5)
Number of contracts used with trsp. providers	S (2.7)	S (2.6)	S (2.5)	L (7.1)	L (5.7)	XL (11.0)	M (3.2)

Another way of presenting an over-view on the total market is to include the categories in the main model, see Figure A7.1 on the next page. Here, the indicators 3-5 show the proportions of the total freight volumes estimated.



**Figure A7.1** The indicators divided in categories, based on the raw data (in brackets) per stratum







