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Managing the Future: Environmental Demands

- A study of the interface between transportation and environment in order to strengthen the Swedish National Road Administration strategic position -

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Abstract

Preserving the environment and maintaining economic growth has become a top priority for many organizations and governments. Governments and businesses have taken actions to work together to address environmental issues, such as introducing new environment regulation and policies. Thus, the main purpose of this paper is to strengthen the strategic position for the SNRA. Further more, we examined alternative methods and technologies in order to strengthen the environmental awareness within the Swedish transportation industry.

Since many groups argue about the complexity of the interface environment and transportation, solving these environmental issues would be better addressed within the logistical framework. For many years, the logistics has been the missing link in providing green goods and services to the consumer. Now, numerous companies have found that green products will be "greener" if the value adding logistics activities can help logistics managers make more environmentally responsible decisions.

In order to assist the SNRA, we decided to examine the behavior of companies in Sweden and in the UK. We sent a questionnaire to numerous companies. The results from the questionnaire indicate that intermodal transportation is becoming more attractive because of its environmental advantages. When analyzing the collected information we found that the environmental policies and regulations are important and companies are working hard to achieve their environmental objectives.

Further, we believe it is possible to influence companies in their way of managing business, such as using new innovative logistical solutions that benefit the environment and the transportation industry. By using different incentives, taxation of emissions and the introduction of new environmental regulation, the SNRA could influence companies' buying behavior.

Key words: Environmental, Logistics, Intermodal Transport, Buying Behavior.

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1 Background

In this chapter, we will describe the background, the problem area as well as the purpose and limitations for our study. The chapter starts with an presentation of the present transportation situation and is followed by a short description of the Swedish National Road Administration.

1.1 Introduction

Sweden is a country that needs improved transportation, less congested roads and more up-to-date, affordable and reliable transport systems. The transport system and services have suffered from decades of under-investment. The result is overcrowding, congestion, delays and pollution. Turning around this trend is not an easy work. It needs huge investments into the transport system and a radical change in organizational behavior. It is the mission of the Swedish National Road Administration and Swedish organizations to make this come true.

Road transport is one of the most important transport modes in Sweden. The majority of personal and freight transport within Sweden takes place on the road. Goods transports, to and from other countries within Europe, especially the Nordic countries, are heavily dependent on road transportation. This is because that goods transport carried out on roads is more economically efficient than by rail and boat, taking time and service in account.

The Swedish National Road Administration (SNRA) is the central administrative agency commissioned with the overall responsibility (sectoral responsibility) for the entire road transportation system. The SNRA is divided into one head office, seven regional offices, two supports and development unites, two profit centers and four business units. Each regional office has a sectoral responsibility for the road transport system within its geographical area and is responsible for road management for the state road network within the region. The profit centers operate as a subsidiary company. They provide services for other units within the SNRA, other authorities, municipalities,

private road managers and private companies.[1] Within the framework of its sectoral responsibility, the SNRA is assumed to take a leading role in promoting and supporting the work of the other actors involved in the road sector. The SNRA shall also actively strive to fulfill the goals in the national transport policy, focusing particularly on accessibility, high transport quality, a sustainable environment and positive regional and sustainable development.

The major responsibilities of the SNRA are: [2]

- Relating to the environmental impact of the road transport system, road traffic safety, accessibility, level of service, efficiency and contributions to regional balance, intelligent transport system, vehicles, public transport, commercial traffic, applied research, development and demonstration activities within the road transport system.

- Drawing up and applying road transport regulation.

- Planning, construction and maintenance of state roads.[3]

Figure 1: Sector responsibility of the SNRA

In general, for the SNRA all the goals in national transport policy are of equal importance. Hence, they must take careful consideration in any given situation

[1] Facts About The Swedish National Road Administration, Roads And Traffic, 2003
[2] Ibid
[3] Ibid

within the areas of operation, so that the action taken contributes as much as possible to the achievement of these goals. This applies irrespective of the task. Integration, an overall perspective and co-operation are key words for achieving good results just as they uphold the principle of public access to official records and the obligation to provide service to the public as well as other public authorities and organizations.

1.2 Discussion of Problems

The present traffic situation in Sweden and in the rest of Europe is characterized by increasing congestion and environmental problems. The organizations within Europe long for reliable and efficient transport systems that support prosperity. During the latter half of the twentieth century the transportation of freight and goods has increased rapidly; however, the growth in freight transportation jeopardizes the expense of the environment. For example, continuing growth in transportation could lead to deterioration in the quality of life for the society as well as for the business community. In addition, the quality of life and nature is affected by increasing health problems, air pollution, noise and accidents.

Sweden expects an increasing economic activity in business and industry. The numbers of employees are increasing, as is commerce; the need for goods and transport service is increasing. This economic trend will result in greater problems with congestion and environmental problems through emissions, noise and discomfort. The SNRA has established a national environmental program to face this emerging threat. Today SNRA mainly focuses on:

- Supporting the development of a national strategy for non-fossil fuels.[4]
- Collaborating in the road transport areas with regional and local actors and finding a measure for solving the health problems resulting from harmful emission of road traffic

[4] National Environmental Programme 2002-2005, 2001

- Developing goals and carrying out measures to protect and preserve environments.[5]

To meet these targets, the SNRA faces many obstacles. Increasing transportation indicates that there is a great need for actions to increase road capacity. At the same time, it is very difficult to find acceptable logistical solutions for necessary investments, especially since there exist conflicts of interest between developing the transport infrastructure and protecting the environment.

Companies and organizations have to change their behavior in the near future; achieving sustainable development in transportation will become a necessity in order to achieve an improved and adequate transportation situation in Sweden. The SNRA is drawing up policies, regulations and establishing programs in order to face future demand on quality and environmental problems for organizations. For example, the way companies purchase transport services is becoming more and more important. When choosing a service provider there are many aspects the organization has to evaluate before deciding.

We will evaluate and examine alternative methods in order to assist the SNRA in finding out what they could do to influence companies in their buying behavior of freight transports as well as becoming more aware of environmental issues. The companies purchasing transport services in order to run their daily operations should consider aspects such as environmental impact and logistical technologies, rather than just the price.

Today the SNRA is working closely with many Departments within the Swedish Government, such as the Swedish National Environmental Protection Agency. However, if the SNRA works closely in partnership with a wide range of both public and private sector bodies, the SNRA can achieve greater understanding among organizations and thereby, better influence companies, actions.

[5] National Environmental Programme 2002-2005, 2001

Since increasing transportation and environmental impacts is a global concern, we think the most suitable way to assist the SNRA's work is to choose another country within the European Union and introduce their experiences and solutions to the SNRA. The selected country should have an equal business standard and a similar transportation situation with Sweden. More important are that transportation policies and regulations should be comparable. Because the UK is a well-established industry country with long history, the transportation industry in the UK is well developed. At the same time, the environmental impacts from transportation industry in the UK are similar to those in Sweden. Because of this, it is interesting to examine both countries, given the policies, regulations and governmental programs. The Department for Transportation (DfT) in the UK, the counterpart to the SNRA, has the same responsibilities as the SNRA. It will be easier for us to present experiences and solutions of the DfT for the SNRA.

In order to find what is done to improve the growing need for improved knowledge regarding the freight transport situation, further research on programs and objectives within each selected Government department of transportation will be carried out.

1.3 Purpose

The purpose is to evaluate and examine alternative methods and technologies in order to strengthen the environmental awareness within the Swedish transportation industry and present the result to the SNRA.

1.4 Disposition of the Thesis

So far, we discussed the underlying problem of the upcoming research. We will start by doing a pre-study within the area of transportation and environmental regulations in order to describe the complexity within road transportation. Chapter two will act as an initial study in order to create a deeper understanding of the initial problem, which we carried out before we started with the actual research process. The impact road transportation has on the environment will be briefly described with related environmental policies and regulations.

The question is then, how to deal with the negative impact that emerges from road transportation. When starting the research process we discovered countless methods and technologies for reducing the environmental impacts. Today, many organizations are becoming more aware of the massive environmental problems, and are forced to act accordingly. However, a number of problems emerged when arguing how to tackle the environmental issues, for example, dealing with the implementation stages, what strategies should be best for a certain situation, how much money to invest and the level of expertise, so far and so on. In chapter three, alternative logistical methods and solutions are described on a more detailed basis, for example, how to reduce the total usage of road transportation using methods such as intermodal transportation. We will further present various examples of how to become a more environmentally friendly organization by utilizing different means of new thinking regarding logistical solutions.

Chapter four deals with the research process where we will describe how we conducted our study and outline the major stages of the process of gathering information. Further, we are going to describe different methods of collecting data.

In chapters five and six, we present the empirical information, case study on the SNRA and DfT and results from the conducted survey. The results from the survey and additional collected data will be analyzed and finally conclusions and recommendations will be covered in chapters seven and eight.

2 Transportation & Environmental Regulations

This chapter concerns the increasing demand for transportation and the different actors involved which are of great importance for understanding the complexity of transportation. The relationship between transportation, environmental and related policies, and regulations will be further discussed.

2.1 *The demand for Transportation*

The role of transportation in logistics operations has changed dramatically over the last decades. The structure of freight transport growth in Europe has changed radically; the most important is the shift from rail transport to road transport and the growth in transportation distance. One explanation could be the change in the logistically induced demand for transport, especially the immense increase in flexibility of production and distribution structures and the improvement in the infrastructure.

The main reasons for the shift from rail transport to road transport are very much dependent on the increase in freight transport demand and increased flexibility in distribution and road transport, especially the truck industry which has played an important role in the total freight transport quantity. Road transport always handles the freight that railroad has difficulty in delivering. Compared with rail transport, the characteristics of freight transported by truck are small shipments and short transport distances.

An additional reason for increased road transportation demand is that the volume of goods with short lifetimes are increasing enormously, goods like vegetables, fruit and meat which must be kept fresh before it is purchased by customers. Due to the relatively short development time, goods such as computers and fashion-based products should be delivered as quickly as possible. Therefore, road transportation already is deemed as a part of the production process ensuring that bits and pieces are assembled using logistics chains. There is also a calculated trade off between the value of goods and the speed of delivery. So, more goods are transported by air to ensure the value.

However, in some cases, air transport is not appropriate for all kinds of goods. For large volume, low value goods, transport costs are very important in the evaluation of which mode of transport to choose. [6]

The most obvious value of transportation is to move products within the logistics chain. This is the vital process to procurement, manufacturing and market distribution. Transportation also can perform a key role in reverse logistics. Transportation consumes time, as well as financial and environmental resources.

The storage function is ignored by many producers and shippers. During the transportation of goods from the origin to the destination, the transport means can be used as storage, but these are comparatively expensive storage facilities. Except for temporary storage, sorting out is another form that transportation can perform. Sorting out occurs when a shipment destination is changed while the product is in transit.

In order to understand the complexity of transportation, it is important to understand the underlying determinants for transportation. Because of its complexity, we first describe different actors that are directly involved in the decision process. Transportation decisions are influenced by groups of actors, as seen in Figure 2: **The relations between involved parties**. The interaction between these six parties defines the complexity of transportation. The following paragraphs explain the main roles and tasks of each involved actor:

- **Public -** The public's needs for goods and services create the demand for transportation. On the other hand, the demand for transportation also creates negative impacts, both on the public in general and on the environment.

[6] Bowersox & Closs, 2002

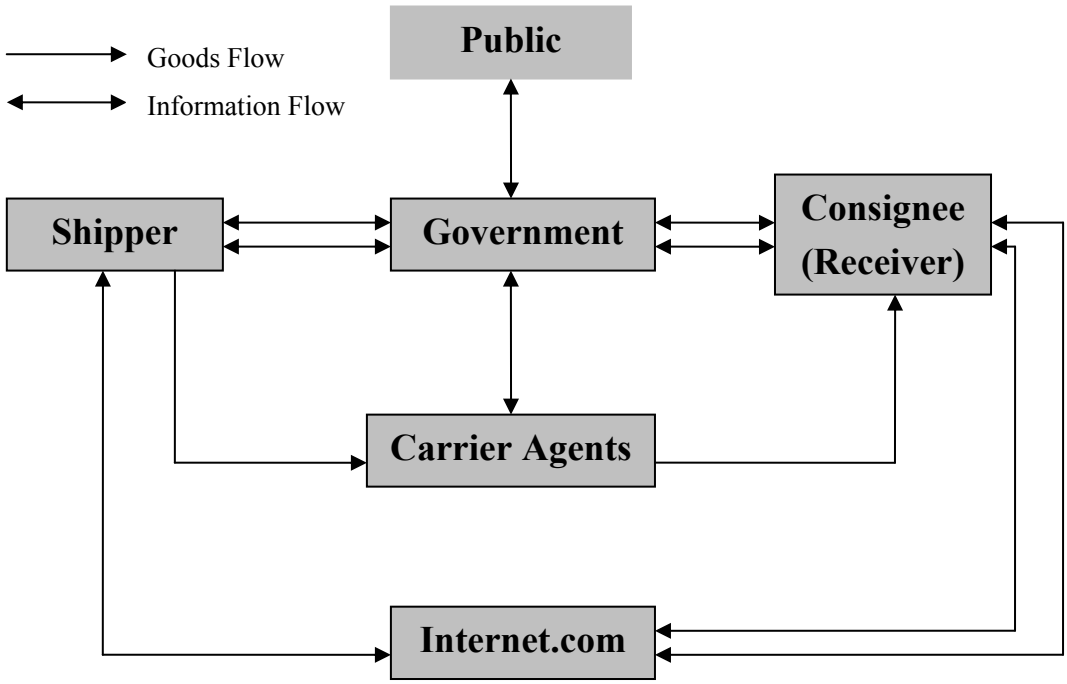

Figure 2: The relations between involved parties

- **Shipper and Consignee -** The shipper and consignee (receiver) have a common interest in transporting the goods from origin to destination within a given time at the lowest cost.

- **Government -** The government is also involved in the transportation because the government desires an efficient and stable transportation environment to support economic growth. The government traditionally regulated the transport market and price, provided the right-of way and supported the research for the development of carriers.

- **Carrier Agents** –The Carrier agent is a kind of business enterprise who performs the transportation task for the shipper. The carrier's objective is to maximize its revenue while minimizing associated costs.

- **Internet -** The Internet can help carriers to increase their service qualities by providing real time information to the customers and

shippers. The increased service qualities can strength a carrier's competitiveness in the market.

2.2 *Environmental Aspects on transportation*

The Transport system plays a very important role in a country's economic development and is an asset in international competition. In the EU, the transport service industry accounts for about 7 % to 8 % of GDP including transport by the same enterprise and private transport. Although there are many benefits we get from the transport, the disadvantages are also obvious. The building and maintenance of transport infrastructure, as well as the nuisances of noise, air pollution and the consumption of energy and natural resources, represent considerable environmental liabilities.[7]

When comparing other transport modes, road transport is the greatest offender to the carbon dioxide emission. The environmental impacts of road transport are mainly classified as, ***air pollution, climate change, noise, and land invasion***.

Air Pollution

Emissions from road transport are the major contributor to air pollution. The most significant conventional emissions from road transport are nitrogen oxides (NOx), carbon monoxide (CO), and Volatile Organic Compounds (VOCs).[8]

NOx contributes directly to acid rain and the build-up of troposphere ozone and indirectly to the "greenhouse effect". Emission of NOx from road transport sector accounts for 45 % of total NOx emissions in 20 European countries. CO is another very important toxic emission which is produced by road transport. It is estimated that the emission of CO accounts for 30 % to 90 % of total CO emissions in different countries. CO has a serious impact on human health, particularly interfering with the absorption of oxygen. VOCs are the product of incomplete fuel combustion and the evaporation of fuel from petrol engines and

[7] Europe's Environment-the Dobris Assessment, 2002

[8] Ibid

service stations. Emissions of VOCs from road transport account for about 35 % to 40 % of total VOCs emissions in EU countries. Particle matter is mainly produced by the use of diesel. The diesel engine can produce particulate matter about 30 to 70 times greater than the petrol engine. Particle matter is also harmful to human health. It can lead to respiratory disease and cancer. Particulate matter can remain in the air for a considerable period and result in particulate smog.[9]

Since exhaust emissions are the major source of air pollution, people are increasingly concerned about how to reduce exhaust emission. For example, several brands of environmentally friendly vehicles have been put on the vehicle market.

Climate Change

Nowadays, climate change is one of the greatest environmental threats to the world. Human activities already have very deep impact on the global climate. The mean global surface temperature has increased by about 0.3˚C to 0.6 ˚C since the late 19th century. A consequence of global temperature increase is the melting of glaciers and ice caps, which results in that the global sea level has risen by about 10-25 cm over the last 100 years. Ecosystems, agriculture, forestry and human health are also very sensitive to the change of global climate.

Studies of climate change put the blame on fossil fuels, since more than half of the oil consumed is done by private cars and in 1998, transport was responsible for more than a quarter of CO_2 emissions in Europe. Much of this growth is due to international road haulage. The forecast for 2010 points to a 50 % increase in freight transport unless some actions could be taken in order to stop this alarming trend. For example, transport by lorry is unavoidable over very short distances, where there are no alternatives. By contrast, sustaining and encouraging the expansion of road transport over middle and long distances is a possible alternative solution.

[9] Europe's Environment-the Dobris Assessment, 2002

The emissions of greenhouse gases, like Carbon dioxide CO_2, Nitrous oxide (N_20) and methane (CH_4) have had a net warming effect. Since the industrial revolution, the level of these kinds of greenhouse gases has risen dramatically. Fossil fuel combustion, increasingly intensive agriculture and an expanding global human population have been the primary causes for this rapid increase. In the EU, road transport currently accounts for 80 % of total transport emission of CO_2.

If the emission of greenhouse gases continues to increase, the effect of global warming will be more intensive. This threat of climate change already catches attention of most countries. Several environment commissions have been established. At the same time, more and more environmentally friendly innovations have already been placed in use, such as cleaner fuel.

Noise

Traffic noise is also a pollutant to the environment and to human health. This unpleasant, unwanted sound has been of increasing concern, both to the public and to local authorities. Sound is quantified by a meter that measures units called decibels (dB). Noise is a very complex phenomenon. The most obvious effect of noise on human health is damage to the ears. Noise can generate high sound pressure. If the sound pressure is too high, the human ear can be irreversibly impaired, which can result in complete deafness, or reduced sensitivity of the ear, or permanent jamming. It will be a risk if a person is exposed to a level of 85dB about 8 hours per day or to a level of 120 dB for a few minutes. [10]

The level of traffic noise is determined by three factors: the volume of the traffic, the speed of the traffic and the number of trucks in the flow of the traffic. Therefore, the heavier traffic volume, higher speed, and greater number of trucks can result in higher level of noise. In the individual vehicle, noise can be produced by the engine, exhaust, and tires. As a result, the malfunctioning mufflers or other bad condition of equipment can produce higher level of noise. Additionally, there are some other complex factors, which can affect the level

[10] High way Traffic U.S. department of Transportation Federal Highway Administration, 2002

of traffic noise, such as road conditions. Distance, terrain, vegetation, and natural and man made obstacles (noise barriers) can reduce the level of traffic noise.

Land Invasion

Since the last century, the construction of road transport infrastructure has covered more and more land. Natural habitats are irreversibly destroyed when transport facilities are built. Damage also arises at extraction sites of building materials and at dumps for rubble from infrastructure work.[11] It was estimated that the road network accounts for about 1.3% of the total land area of the EU. In Europe, the total length of road network is much longer than the total length of rail network, and it is still expanding.

In 1998, nearly half of all transported freight was transported by road. Between 1970 and 2000, the number of cars has trebled from 62, 5 million to nearly 175 million. Every day roads cover about 10 hectares of land, and most of the road building has been in regions farthest from the centre. This is a method to help their economic development.

Generally, if there is not an appropriate understanding of the relationship inherent in the environment function, the environment can be seriously disrupted. It will take a long time to regain equilibrium, even several generations. This means those generations must function in a debilitated environment. However, changing this behavior now and aiming towards achieving a sustainable environment by becoming more aware of the disrupted relation between transportation and environment might be possible to offer coming generations a better life.

2.2.1 Sustainable Transportation

The main task for the transportation industry is to find or establish a balance between transportation and environment. It is not easy to find the most optimal solution. By integrate environmental concerns with transportation decisions, it is possible to create a sustainable transportation development. Transportation facilities and activities have significant impact on sustainability. As seen in

[11] Europe's Environment-the Dobris Assessment, 2002

Table 2.1: , strategies that increase transportation system efficiency and reduce negative impacts from transportation are among the most effective ways to make progress toward sustainability objectives.[12]

Economic	**Social**	**Environmental**
Traffic congestion	Inequity of impacts	Air pollution
Mobility barriers	Mobility disadvantaged	Climate change
Crash damages	Human health impacts	Habitat loss
Transportation facility cost	Community cohesion	Water pollution
Consumer transportation cost	Community livability	Hydrologic impacts
Depletion of non-renewable resources	Aesthetics	Noise pollution

Table 2.1: Impacts of transport on sustainable objectives.

It is vital to identify strategies that help to achieve multiple objectives and avoid those that solve one problem but exacerbate others. The most sustainable strategies are those that simultaneously help reduce traffic congestion, pollution, crashes and consumer costs, increase mobility options for non-drivers and encourages more efficient land use patterns. Strategies such as the "Win-Win solutions" are normally used to achieve sustainable development.[13]

Within the area of sustainable transportation planning, a paradigm shift is inevitably, a fundamental change in the way people and organizations think about and solve problems that will take place. It will require comprehensive analysis of impacts, consideration of indirect, cumulative impacts and of demand management solutions and public involvement in transportation decision-making. In general, it means offering higher value trips and giving lower cost modes priority over lower value, higher cost trips.[14]

Sustainability emphasizes the integrated nature of human activities and therefore the importance of comprehensive planning that coordinates sectors, groups and jurisdictions. Lately this has become very trendy, especially since

[12] Daly, 1996

[13] Victoria Transport Policy Institute, 2003

[14] Litman, 1999

existing institutions are often poorly suited to address complex, long-term problems.

Defining the concept "sustainability" is quite difficult; there is no generally accepted definition of sustainability, sustainable transport or sustainable development, but the most common one is.

"*A sustainable transportation system is one in which fuel consumption, vehicle emissions, safety, congestion, and social and economics access are of such levels that they can be sustained into the indefinite future without causing great or irreparable harm to future generations of people throughout the world."*[15]

Within many organizations the decision-makers tends to focus on easily measured goals and impacts, while ignoring those that are indirect or more difficult to measure. Traditional planning often reflects a reductionism approach, in which a particular organization or individual is responsible for dealing with a particular problem. In some situations, this approach could be appropriate. However, it often results in solutions to one problem but exacerbates other problems, or fails to implement solutions that provide modest but multiple benefits.

Sustainable decision-making can be described as "comprehensive planning" that considers a wide variety of goals and effects, regardless of how difficult they are to measure. Traditional planning normally uses a 5-20 years period, which is less than one generation. However, sustainability is also concerned with long-term risk, such as harmful pollution and climatic change that may harm people decades or even centuries in the future.[16]

[15] Richardson, 1999

[16] Victoria Transport Policy Institute, 2003

2.3 *EU regulations*

The following part concerns the environmental regulations and policies within the EU and Sweden.

2.3.1 **Environmental regulations and policies**

Sweden and the UK are both members of the European Union. Each country built up its own transportation infrastructure by using their systems and standards. These systems and standards make creating a homogenous market very difficult. For example, creating a common policy for all different areas such as economic law, social questions, police enforcement and transportation policy will be an extremely complicated task.

Transportation is a key factor in modern economic development. However, today it is extremely important since many companies need transportation in order to sell their products globally. As demand for more efficient transport keeps increasing, the answer is not always to build new infrastructure and open up new markets. The system in itself has to be optimized to meet demands of enlargement and sustainable development. The different modes of transport must be able to work together instead of competing with each other. The transport system must be sustainable from environmental, economical and social viewpoints as well.

In the near future, it will be necessary to increase competition among today's available modes; if not, there will be an imbalance. Since the road traffic is growing rapidly, it necessary to bring it under control and to make modes such as rail and sea shipping more competitive alternatives. Because of this, regulations that control competition have to be developed.[17]

2.3.2 **Policies and Regulations – European Union**

Very few measures have been taken at Union level to provide a basic regulation of social conditions in the road transport sector. This goes some way towards explaining the sector's high competitiveness. For the Council of Ministers, it took until December 2000 to decide to harmonize driving time for truck drivers

[17] Transport Policy: Time to decide, 2001

at a maximum of 48 hours per week on average. However, in other modes, the rules have been too strictly regulated, i.e., with train drivers who are restricted to an average of 22-30 hours per week.

Different Commission proposals in the European Union are designated to improve working conditions and ensure compliance with the rules and policies for the operation of the internal market. In particular, these proposals seek:

- To harmonize weekend bans on trucks; this proposal seeks to align the national rules in this area and to introduce an obligation to give notification before such bans are imposed.
- To introduce a driver's certificate; this will enable national inspectors to conduct more effective checks and to make sure that the driver is legally employed and, if necessary, to record any irregularity.
- To reorganize working time though self-employed drivers are excluded. This proposal will regulate working time throughout Europe, establishing an average working week of 48 hours and a maximum of 60 hours.
- To develop professional training; obligatory initial training for all new drivers of goods.[18]

By adopting this package, it will be one-step on the way to develop a high-quality road transport system throughout the European Union. Controls and penalties are also imperative. EU regulations have to become more effective than they are at present. It is normal for a driver whose driving license is suspended in one Member State to be able to obtain another in a neighboring country. By the end of 2004, the Commission plans to accept a proposal on the harmonization of policies regarding controls and penalties, which is designed to:

- Promote efficient, uniform understanding, implementation and monitoring of Community road transport legislation.
- Harmonize penalties and the conditions for immobilizing vehicles.
- Encourage systematic exchanges of information.

[18] Transport Policy: Time to decide, 2001

To achieve this new action package, new technologies will become unavoidable, for example, the introduction of the *digital tachograph*, a device to record data such as speed and driving time over a longer period than is possible with the mechanical tachograph of present. This will lead to better monitoring, observation and will lead to better reliability.[19]

2.3.3 **Policies and Regulation – Sweden**

The extent of government involvement in transport infrastructure issues and operations is an important factor, which influences the regulations, policy approach and priority assigned to various transportation policy development and implementation. In recent years, environmental concerns have placed greater focus on the role of freight transport, and new regulations are under development.

On the national level, according to the SNRA, a road transport system should be developed in a way that it does not have any negative impact on the environment. The environmental policy adopted by the SNRA lays the grounds for developing the road transport system, towards a situation in which the climatic impact of road transports is acceptable, the level of vehicle emissions is acceptable, noise levels are tolerable, natural resources are being conserved and the infrastructure is adapted to the natural and cultural environment.

From the environmental policy of SNRA, several organizational approaches are found:[20]

- Use careful method in roadwork and other facets of SNRA's operations.
- Critically consider all use of any harmful or unnatural substances.
- Locate and design roads, bridges and other infrastructures so that they are in harmony with the surrounding environment.

[19] White paper - European Transport Policy for 2010: Time to decide, 1999

[20] National Environment program 2002-2005, 2001

- Work together with individuals in society, the business community, other authorities and organizations, and take advantage of their specialist, commitment and desire to assume responsibility.
- Deal with environmental issues in an open and competent manner.
- Steadily improve themselves.

The Swedish government has to take on an active role in designing new regulations in order to co-operate with the imbalance that take place between the different modes. Similar to the European Union regulation, a shift in the balance has to take place. Regulation at the European Union level is not enough to promote the change. The regulation has to come from the inside of a given country.

3 A Logistical Perspective on Transportation

In this chapter we will discusses methods and concepts, which examine logistics issues relative to the environment, such as intermodal transportation and green logistics. Further, we argue for measures that can be taken to achieve a proactive environmental management focus. The chapter concludes with discussions regarding organizations' buying behavior and successful concepts such as "implementing green logistics" and the results of "Win-Win strategies" in organizations.

Because the nature of logistics management is cross-functional and integrative and countless logistical activities influence the environment, it makes sense that logistics activities important. The following sector will deal with concepts and methods concerning various logistical solutions.

3.1 *Logistics Solutions*

Different forms of transportation have various degrees of suitability for separate market segments, which often depending on factors such as the transport distance, the types of freight and transport routes. Trucks dominate transport distances of less than 300 km, while ships and railways are more used for longer distance transports. Normally a single transport task usually involves different transport forms to work together in a chain. Every form of transport is used for that part of the chain where it is strong, in comparison with its alternatives. The competitive interface between the different forms of transports is therefore limited.

It is often better to combine road and rail transports from an environmental point of view than transport by truck only. However, over short distances this may not be entirely true. From an environmental point of view, when transporting freight, it is best to use the transport solution which produces the least possible environment effect. By joint loading and coordinating return transport, vehicles can be utilized better and the number of vehicles needed to cover the transport demand reduced. This will require flexible solutions. Greater flexibility is achieved through a higher degree of coordination between

transporters and transport service purchasers, and between transporters and purchasers among themselves.

Greater efficiency must mean that each type of transport is utilized better and that co-operation improves dramatically. It does not help by only optimizing one type of transport; a holistic approach is needed to avoid sub-optimization. This holistic approach should also be applied when designing new terminals. The terminal plays a key role in the transport system. The demand for faster delivery times can be countered through shorter waiting times, better schedules and faster loading and unloading in the terminals.

IT (information technology) can also be an effective tool when making transport system more efficient. For example, GPS (Global Positioning System) can provide information on where a vehicle or consignment is at a certain time. Further more, GPS technology offers possibilities for advanced route-planning systems for distribution by truck and traffic management systems for railways. GPS is used in shipping and aviation for navigating. IT facilitates joint loading and customer contact. It is also technically possible with road traffic systems to divert vehicles from sensitive areas. These IT applications are different ways of making the flow of freight more efficient. IT, by itself, cannot reduce the environmental loads from transports. It is rather a tool to bring about other changes, such as reorganizations and changing behavior.[21]

As everything else within a company, many marketing decisions affect logistical operations. Customer service level and distribution channels have a direct impact on logistics. A frequent task for managers is to make correct trade-offs decisions between different activities, between transport and inventory and between information and inventory. The same service levels can be maintained with lower inventory, speedy and reliable transport, or with high inventory but inexpensive transport. Information can be used to replace large inventories in the logistics system. Many manufacturers are linked with retailers' computers so they can tap into checkout counter data real time. It results in more accurate sales predictions and logistical planning of goods

[21] Chalmers University of Technology, 2002

movement. By using efficient information system in the form of efficient consumer response (ECR), coordination of its schedule of future requirements to major suppliers is enhanced. ECR enables each player in the network to synchronize its production and logistics resources so that surprises can be largely eliminated. For example, two transportation providers could join to provide seamless transport to meet the buyers' demand by consolidating transport freight. Shared information allows them to move merchandise in the form the stores want. Better information systems such as ECR are considered environmentally responsible because they cut down waste such as excess inventory and inefficient shipping via better prediction, co-ordination and increase in the load factor.[22]

3.2 *Intermodal Transportation*

During the last 30 years, the motorway network has been growing by 1.200 kilometers every year within the EU. Comparing rail transport at the same time in the EU, it has meant that 600 kilometers of railway lines have closed each year. Considering this, the greatest growth potential is taking place in the rail market for long distances transportation.

Optimum use of existing infrastructure also means taking account of the noise produced by railway vehicles. Current estimations by the European Environment Agency put the number of people bothered by train noise at three million. The Interoperability Directives therefore provide for limits on noise emissions from rolling stock.[23]

Intermodal freight transportation is a means of delivering goods, particularly over longer distances, in which two or more, individual transport modes, for example, road transport and rail freight, are used together to provide the most economic and efficient method of conveying goods from their source to their destination.

Typically, such operations involve the movement of either:

[22] Chalmers University of Technology, 2003

[23] White paper - European transport policy for 2010, 1999

- Complete, driver-accompanied, road vehicles which travel both on the road and are conveyed on rail for the long distance transport, for example via Euro tunnel's Freight Shuttle service through the Channel Tunnel.
- Unaccompanied articulated semi-trailers carried piggyback, ISO-type shipping containers or intermodal swap bodies which are transferred from road to rail and vice versa in order to complete a freight journey in the most efficient and economical manner.
- Road vehicles carrying ISO containers or swap-bodies from the point of loading to a rail terminal where they are transferred to rail for onward shipment.
- Road vehicles carrying ISO containers from the point of loading to a rail terminal for rail-haul to the port for short-sea or deep-sea shipping.
- Freight (invariably in bulk loads) deep-sea shipped by transferring to barge for onward movement by barge or lighter.

Combined road-rail transport, which is the most well known form of intermodal transportation, certainly in the UK, is a specialized sector within the broader concept of intermodal transportation. Government and environmentalists have for a long time been driving a campaign to see a switch of more freight from road to rail in the interests of reducing road traffic congestion and the various polluting effects of heavy trucks operating within the community.

These systems combine the best attributes of both road transport and rail freighting. Road haulage can provide an flexible local collection and delivery service to premises, which may be in a congested urban area. Rail freighting, on the other hand, provides the long-haul facility for conveying whole trainloads of freight between terminals, quickly, economically and relieving the overcrowded road network of many heavy truckloads.[24]

The objectives of intermodal transportation are to improve the effectiveness and efficiency of the door-to-door integrated service transport chain. The main

[24] White Paper – European transport policy for 2010: Time to decide, 1999

objectives for promoting intermodal transportation range from the efficient use of existing infrastructure and the promotion of operational business efficiency to environmental concerns.

The Government Role in Intermodal Transportation

In order to succeed with the objectives the government has to take an active role in designing the transport infrastructure and examining regarding transport operations. Furthermore, the government needs to be actively involved in intermodal policy development and the intermodal actions taken by their transport operations. This recognizes that many of the intermodal issues which need to be addressed by government and private sector organizations are likely to be related to facilities (such as ports and intermodal terminals) or operations (such as combined transport involving rail services) which involve government ownership. [25]

Governments have to develop policy instruments to encourage the use of intermodal transport. The main policy instruments currently in use are:

- Strategic planning to integrate freight distribution infrastructure with land-use plans.
- Regulatory and legislative initiatives, which include regulation of vehicle weight and dimensions.
- Economic instruments such as taxes and charges.
- Financial assistance to government transport operations to stimulate the development of terminals, transfer points, and support of the purchase of intermodal equipment.
- Initiation, leadership and support for intermodal demonstration projects involving the private sector.
- Financial incentives, including support for research and development.[26]

There exist a number of detailed country responses which can assist other countries interested in intermodal policy development, provide examples of

[25] Organisation for Economic Co-operation and Development, Intermodal Freight Transport, 2001
[26] Ibid

additional measures, which go beyond the traditional administrative focus on transport infrastructure and regulations. These include:

- Development of long-term visions and policy directions encompassing intermodal transport.
- Promote regional and urban intermodal transport and plans and spatial planning measures favoring intermodal transport efficiency.
- Measures to ensure adequate co-ordination (such as bringing all modes under one administrative umbrella)
- Policies aimed at standardization of loading units and other actions favoring interoperability.
- Monitor the economic and environmental performance of multimodal chains.[27]

Success with implementation of intermodal transportation policies will require co-operative arrangements between government and the private sector. For one reason, intermodal services generally involve freight transfers between transport operations and infrastructure with different ownership structures.[28]

The chances of intermodal transport policy being successfully implemented depend on the relationship between intermodal transport policy units (or other policy structures), industry advisory bodies and other stakeholders, including:

- Intermodal transport policies and regulations which stand a greater chance of being successfully implemented if the industry bodies and intermodal transport policy units or other structures have clear lines of communication with other government ministries, such as finance, environment and trade, etc.
- The formation of industry advisory government consultancy boards, with a clear role and function, increasing the probability of intermodal transport policies targeting the key issues; such industry advisory groups

[27] White Paper – European transport policy for 2010: Time to decide, 1999
[28] Ibid

are more effective if they have clearly defined tasks and report directly to the minister responsible for transport.

Further, work should concentrate on developing benchmarks for intermodal performance of modes, modal combinations and modal interfaces and identifying policy options for governments to address impediments to intermodal efficiency.

In order to achieve effective and efficient intermodal transportation, a shift in the balance between different transportation modes must take place. The missing link today is lack of a close connection among sea, inland waterways and rail. The key components are linking up sea, inland waterways and rail. These areas have an enormous potential growth. Up until now, these transport modes have been neglected. One way to make this more competitive is to build motorways of the sea and offer efficient and simplified services. Another advantage in using these modes is that they are very safe, especially for transporting dangerous goods, such as chemicals and hazard freight.

The major constraint for rail, inland waterway and sea is that they are unable to offer door-to-door services. Loading and unloading wastes time and adds cost. In comparison with other transport modes, road transport has the advantage of being able to carry freight almost anywhere. Research within this area is necessary must create technical conditions for developing the profession of freight integrator, and standardized unit loads.

These freight integrators must be able to combine the specific advantages of each mode within EU and worldwide, to offer the best service in terms of efficiency, lower price and environmentally friendly transport. This will become more attractive to clients, customers and the society.[29]

[29] White Paper – European transport policy for 2010: Time to decide, 1999

3.3 *Green Logistics*

From the late 1980s, "Greenness" became a catchword in the transportation industry. In 1987, the World Commission on Environment and Development Report established "The Environment Sustainability" as a goal for international action, and said political and economic areas must start to pay more attention to the green issue.[30]

Companies involved in the freight transportation industry are mainly supportive of strategies that enable them to reduce transport cost in the present competitive market environment. The cost saving strategies pursued by logistics operators are, however, often at variance with environmental consideration.[31] This means the users realize the benefits of logistics. However, society and individuals are unwilling to accept this cost. This requires the transportation industry as well as the government to put more environmental consideration in their activities.

Green logistics is a system, which makes transport a working part of products' total quality and gives customers' development a boost, is gaining importance all the time. [32] Green logistics not only help customers' transports to live up to current and future regulations by authorities, but also provide a smart and useful business resource to customers. Nowadays, "Green" has become a more and more important criterion in decision-making process when customers plan to purchase logistics services.

The essential principle of green logistics combines the economic approach and ecological approach to create a long-term environmentally friendly logistics solution. The second principle is that the resource, which was taken from nature, should be used in a sustainable way. The resource should be re-used or recycled as material or energy and finally be disposed with the least possible use of resources, without damaging the environment.[33] The last principle of green logistics is those products, technology and approaches, which are less advanced, should be changed by better ones as soon as possible.

[30] Button & Hensher, 2001
[31] Ibid
[32] Lumsden, 2002
[33] Ibid

Green logistics mainly concentrates on some specific areas.[34]

- Environment effects
  - Environmental impact assessments
  - Global or local field of reference
  - Control air emission within combustion process or catalytic converters.
  - Engine, road noise
  - Traffic accidents, which include congestion effects
- Best mitigates the effects of transporting a known quality of goods.
- In reverse logistics process, increased use of recycling and reuse has the potential to increase efficiency
- Logistical restructure of problems, such as increasing trend for JIT usage and centralized storage.

For instance, efficient route planning involves transporting the right things to the right place at the right time by choosing the shortest possible route. Assisting by Global Positioning System (GPS) and the Mobitex system, supervisors can rapidly find the location of truck which is closest to the new assignment and send the new assignment to the appropriate truck. This operation avoids unnecessary mileage, reduces the environmental load, and increases the operation efficiency[35].

Green logistics should be applied in a system, which includes emission calculations, environmentally adapted logistics solutions, system performance and system evaluation. This system should work as a circle to continually evaluate the performance of the system and make improvements.

In brief, individual logistics companies are finding a balance between environmental considerations and profitability. It is becoming acceptable within the industry to adopt green measures. Green logistics not only can

[34] Lumsden, 2002
[35] Ibid

reduce the cost but also can lead to more intangible benefits such as image and reputation enhancement.

Implementation of Green Logistics

Many organizations have adopted environmental policies and carried out environmental audits in response to various legislative pressures, green logistics, green marketing opportunities, increased public pressure and ethical concerns. However, it can be difficult to find systematic ways of implementing commitments to environmental management and translating recommendations into action. Therefore, Environmental Management Systems (EMS) has been developed to cooperate with the raising difficulties in implementing and understanding these kinds of questions. Most EMS consists of stages which organizations follow to ensure that the environment is being considered in policies and processes. The stages are very similar to those which were presented in TQM systems. An EMS is defined as the organizational structure, responsibility, practices, procedures, processes and resources for determining and implementing environmental policy. The basic steps of an organization's EMS are illustrated below:[36]

- A policy statement indicating commitment to environmental improvement, conservation and protection of natural resources
- A set of plans and programs to implement policy inside and outside the organization
- Integration of these plans into day to day operations and into the organizational culture
- The measurement, audit and review of the environmental management performance of the organization against the policy, plans and programs
- The provision of education and training to increase understanding of environmental issues within the organization, and
- The publication of information on the environmental performance of the organization.

[36] Netherwood, 2002

Other widely used systems are ISO 9001 and ISO 14001 to help with the implementation of an EMS. It can be seen that the described steps are very similar to TQM approach. The main link between EMS and TQM systems is that they both aim to achieve a continuous cycle of improvement through the commitment of the whole organization. Systems such as eco-management and ISO-14001 have been developed to provide organizations with a framework to implement an EMS within their organization.

The success of implementing an EMS largely depends upon training, encouraging an understanding the issues involved by employees, and developing an understanding of their role and responsibilities within the green process. To successfully implement an EMS, it is of great importance to change the organizational culture. Training can play a key role in increasing people's awareness of environmental issues and achieving a certain level of understanding of issues such as energy and waste management techniques. It is very important that training take place on all levels within the organization, including top-level management. Without top-level management involvement, making organizational changes a reality is difficult. Top-level management has to encourage these changes, promote and communicate them throughout the entire organization.

However, there exist some criticisms regarding the EMS. For example, misjudging the process of organizational change will create additional layers of bureaucracy. Difficulties in coordination of EMS in large organizations can result in delay.

The implementation of green logistics can provide benefits to the economic and social sectors.

- By implementing green logistics, the company can obtain a stronger competitive advantage. This is the major attraction to those companies, who want to differentiate themselves from other companies in the highly competitive logistics market.
- It can help company to meet current regulations, which are related to the environment, such as ISO 14000.

- The reverse logistics solution can provide a more efficient and environmentally friendly way for the company to separate, disassemble and prepare for the further use of those used products and packaging material.

3.4 *Organizational Buying Behavior*

One of business' most important purposes is to satisfy their customer. As we known, in many businesses, the customers are organizations. What ever a business firm, a government agency or a school, the organization must purchase the goods or service to conduct its business. Because of the complexity within those organizations, the buying decision processes are essential for developing effective marketing strategies.[37]

The definition of organizational buying behavior is the decision-making process by which formal organizations establish the need for purchased products and services, identity, evaluate and choose among alternative brands and suppliers.[38]

During the buying decision process in the organization, there are some characteristics of organizations which need to be considered.

- Many people should be involved in the process and different people should play different roles in the decision making process.
- Some major technical complexities which related to the products or services to purchased should be considered.
- Organizational buying decision is a more time consuming process compared with individual buying decision.
- There are significant lags between the application of marketing effort and obtaining a buying response.
- To the supplier, every potential buying organization is very different; the supplier should consider each potential buying organization as an isolated market segment.

[37] Webster & Wind, 1972
[38] Ibid

- The organizational members participating in the buying function are always influenced by economic, emotion and other irrational factors.

The buying behavior can be influenced by different factors, which include Individual Factors, Group Factors (Interpersonal Factors), Organizational Factors and Environmental Factors. Even a few variations in one factor can result in different buying decisions. These influences can be simply expressed as a model below; figure three can demonstrate how the variation of these factors influences the buying decision.[39]

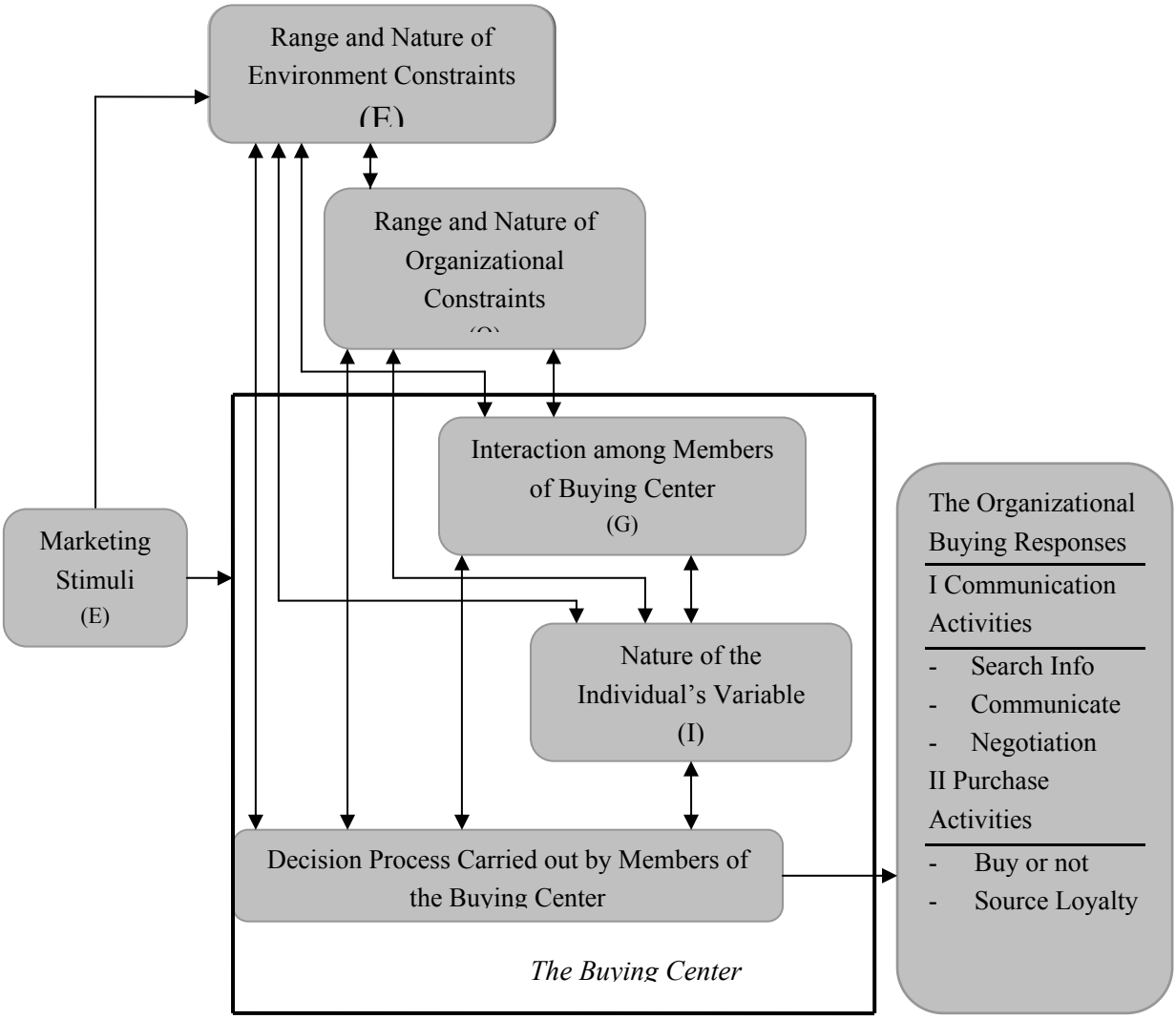

Figure 3: Organizational Buying Behavior[40]

[39] Webster & Wind, 1972

[40] Ibid

As stated above in the model, buying decision is influenced by four interacting sets of factors: environmental, organizational, interpersonal and individual.

- **Environmental factors -** Environmental influences are subtle and pervasive. Those factors influence the decision making process mainly from the society and other organizations. There are some kinds of highly interrelated environmental influences: physical, technological, economic, political, legal and cultural. Additionally, the marketing stimuli also can influence the environmental factors.

- **Organizational factors -** The influences come from the inter-organization, such as objectives, policies, procedures, structure and system of rewards, authority, status and communication within the organization.

- **Interpersonal factors -** In the organization, the buying decision is always carried out by a group of people. These people usually take different roles in the decision making process, which includes influencers, users, deciders, buyers and gatekeepers. These four roles constitute the buying center. Therefore, the interaction between those individuals can influence the result of the buying decision. All members in the "buying Center" can be seen as influencers, but not all influencers occupy other roles.

- **Individual factors -** Although the buying decision is conducted by a group of people, the decision-making system is always set by individual behavior. The individual behavior can be influenced by individual's goals, experiences, habits etc.[41]

Buying of services

It is very difficult to find one universally accepted definition of the term service. Different authors provided different definitions. The most common one is Grönroos's definition of service as an example.

[41] Webster & Wind, 1972

"A service is an activity or series of activities of more or less intangible nature that normally, but not necessarily, take place in interactions between the customer and service employee and/or physical resources or goods and/or system of the service provider, which are provided as solutions to customer problems."[42]

The buying of services is different from buying of goods. The most important characteristic is the intangibility and the invisibility of services. Compared with buying of goods, the intangibility makes it more difficult to judge the services provider's quality when the organization purchases services. It also increases the degree of complexity and uncertainty of the decision-making process.[43]

During the buying decision making process, the buying behavior can be influenced by different services. We classify the business services into different groups: facility services, financial services, information and communication technology services, business organization services, research, development and technical services, transportation and distribution services, human resource development services, and marketing services.[44]

3.5 *Acceptance and implementation of Win-Win solutions*

Win-win solutions are much more technically feasible, cost effective, market-based strategies that provide a combination of economic, social and environmental benefits. By successfully implementing this concept, it is possible to remove distortions, and encourage more efficient transportation behavior. They are also appropriate for helping to achieve more sustainable transportation. Most of the win-win solutions do not require any new institutions or organizations, which could remove further layers of bureaucracy and make implementation process easier.

[42] Grönroos, 1990
[43] Wallström, 2002
[44] Ibid

Other usual transportation improvement strategies solve one or two problems, but normally exacerbate others. For example, by adding a new roadway or increasing the present capacity can help to reduce traffic congestion. However, larger roads, the increased vehicle traffic speeds, and the volumes that result tend to contradict other economic, social and environmental objectives.

How do Win-Win strategies Work?

In order to understand why great benefits of using Win-Win strategies are possible to achieve for all actors, it is useful to consider some basic market principles. Efficient markets have certain requirements, including consumer choice, competition, cost-based pricing and economic neutrality in public policies. Most markets generally reflect these principles. Consumers pay directly for most costs associated with producing housing, food and clothing. However, often transportation markets violate these principles. Win-win solutions tend to correct these distortions as is depicted in Table 3.1, which could result in a more efficient and equitable transportation system.

Market Requirements	**Current Market Distributions**	**Win-win Solutions**
Competition, producers must face competition to encourage innovation and efficient pricing.	Services are provided as public monopolies, little competition or incentive for innovation.	Win-Win Solutions remove barriers and encourage competition and innovation.
Cost-based Pricing, prices should reflect costs, no external costs unless specifically justified.	Transports are under priced; costs are fixed or external, which results in economically excessive levels of driving and automobile Dependency.	Many Win-Win Solutions result in efficient pricing. Some require subsidies
Public policies (laws, taxes, subsidies, and investment policies) should apply equally to comparable goods and users.	Tax policies and many transportation planning and funding practices favor automobile traffic over demand management alternatives	Win-Win Solutions help correct existing biases in transportation planning and investment practices.

Table 3.1: Win-win solutions support Market Efficiency.[45]

[45] TDM Encyclopedia, 2003

Table 3.1 does not mean that driving is a bad thing or that it provides no benefits. However, in a more efficient and neutral transport market, consumers would choose to drive less than they do now and be better off as a result. This could be compared to the following situation, for example; food is vital for life and therefore provides benefits. However, this does not mean that more eating is necessarily better, as presumably many people would benefit from eating less.

Similarly, transportation providers' benefits are not necessarily meant that more driving is better. Win-win solutions are a type of preventive medicine, equivalent to putting the transportation system on a healthier diet. This can avert more difficult and expensive measures that would otherwise be required to address the various problems resulting from increased motor vehicle traffic.

According to the authors, many people are skeptical that Win-Win strategies are feasible, because they require consumers, such as individuals and organizations, to change their transportation behavior and to support policy changes, such as pricing reforms. Like all new ideas, changes are very difficult to implement. There are examples of successes, including recycling, smoking reductions and seat belt use. In all these cases, a combination of public and organizational education, policy changes and support services have had a dramatic impact on behavior patterns, which indicate that consumers can support such changes both politically and individually.

As mentioned previously, Win-Win strategies provide multiple benefits in the sense that they offer opportunities for cooperation and coordination between different interest groups. People, organizations and governments concerned with congestion, road costs, economic development, consumer cost and environmental quality all have reasons to support these strategies. This creates the potential for broad political support. A first step towards implementation of the Win-Win solutions is to develop coalitions to support reform programs.[46]

[46] TDM Encyclopedia, 2003

4 Methodology

In the following methodology chapter, we will present the method we have selected and will describe how we plan to conduct our study. It includes the research method, research process, and different methods of data collection. Finally, we will discuss the validity and reliability of the research.

4.1 Research design

When planning the process of our research, we have had to use different research models. In order to be able to solve the problem raised in this thesis, we have tried to structure our work in a way we believe to be appropriate for obtaining the best result. The development of the thesis consists of two different studies, a pre-study followed by a main-study. These two studies have been performed separately and are of different designs.

4.1.1 **The Pre-study**

At the beginning of our work, we performed a pre-study, form of a case study, which can be seen as exploratory research. An exploratory study can be described as "general picture" research and can be used for many reasons. Other objectives with this kind of research are to clarify the concepts and break a broad and vague problem definition into smaller and more precise sub-problems. Further more, it can be used as basis for setting the priorities for further research.

All the given circumstances of an exploratory research are more or less applicable to our case. The pre-study help us to understand the situation of the SNRA and its market conditions. Through this information, we were able to develop a more precise problem formulation. It also helped us to design the main-study in a more accurate way.

Our pre-study consists of a literature research, Internet, benchmarking and observations. The literature research consists of general theories regarding various environmental and logistical regulations and policies, both on National

and on European Level, understanding the organization of the SNRA as well as the organization of the DfT. Further more, there is abundant information on the Internet, which has been of great help for us. Especially the homepages of the SNRA and the DfT were of great help for us. However, one should be aware that the Internet's credibility before using the information. In order to decide which information should be used and which information should not to be used, one has to know about the origin of the information.[47]

By examining the different environmental programmes and research projects, we carried out a sort of benchmarking at both the SNRA and the DfT, in order to get insight into each of the departments environmental programmes and their way of working.

By using the case study approach, we believe that it can help us in our research process by conducting our work in a more systematic way. Carrying out a case study means that an investigation is done on a well-defined group of objects. It could be an organization or a situation. In a case study, more than one object could be examined at the same time, for example, two organizations such as the SNRA and the DfT. Preliminary case study proceeds from an overall perspective and tries to get a holistic view in order to acquire as much information as possible.[48] Case study includes investigating a relatively small number of objects, and collecting and analyzing information about a large number of features of each object.

To create an easily comprehensible picture of the case study, the chosen theory should be used in a way that without using complicated concepts, it can be easily understood.[49]

4.1.2 **The Main-study**

The main-study was design different from the pre-study and can be seen as descriptive research. One of many purposes of descriptive research is to

[47] Patel & Davidsson, 1991
[48] Wiedersheim & Eriksson, 1991.
[49] Ibid

describe the characteristics of a certain group or a set of objects. It is used to give answers to questions like *who, what, when, and how.*

The purpose of this study for us was to gather empirical data from companies. This information would then help us to find the answers to defined problems.

In order to get a holistic view of questions regarding transport, logistics, and environment, a questionnaire was formed in our main-study. [50] We sent out the questionnaire to 30 Swedish companies and to 20 British companies. The criteria for selecting companies was to obtain a wide range, both domestically and internationally, large and small, considering the number of employees.

One problem with questionnaires is that the respondent is often unwilling to take the time to answer it. In order to overcome this problem, we decided to form short and relatively easy questions so that it would not take too much time to complete. It is also of importance that the respondents could feel secure and relaxed when answering; in order to realize this, we guaranteed anonymity. [51]

In order to get accurate investigation results, the selection of investigation companies is critical. There exist some criteria when we selected the investigation group. Because road transport is used by different kinds of companies, we have chosen companies, which heavily rely on road transport in their day-to-day business operations. Another criterion is that we must survey different kinds of companies evenly. So when selecting manufacturers, we also considered what line of business they belonged to.

After discussion with the SNRA, we decided to focus on four different kinds of industries: Transportation Industry, Food Industry, Manufacturing Industry and Forestation Industry.

We decided to select two kinds of investigation groups. The first choice for our investigation group is the transport provider. The second investigation group is

[50] Appendix 1.
[51] Winter, 1987

the transport service buyers, because they normally use roads as one of the most important way to move the raw material, finished or semi finished products.

4.1.3 **Follow-up**

In order to increase the response rate, it is very important to follow up the questionnaires, which we do not receive in the first stage. Normally if one cannot got answers within a week, receiving further answers are not likely to happen. Ordinarily, one has to be satisfied with a result of 50-75 percent.[52] Because our deadline expired, we contacted the companies by phone in order to increase the percentage of answers. The final rate of answering was 70 percent.

4.1.4 **Strengths and weaknesses**

Our questionnaire does not go in depth in a specific problem; however, it does paint an overview picture of the situation. The advantage is that the questionnaire is relatively easy to complete and you can reach a large number of respondents. In retrospect, now we can see that some questions were poorly formulated and somewhat unspecified. [53] We believe that the questionnaire's validity is relatively high due to the high answering rate of 70 % in total. Of the 30 questionnaires, we sent out to the Swedish companies, we received 22 answers (73% answering rate) and of the 20 British companies, we received 13 answers (65% answering rate).

Additional, we received much help from the SNRA, such as publications and annual reports.

4.2 Reliability and Validity

When designating a research it is important logically to link the data to be collected to the initial questions of a study. In the most elementary sense, the design is the logical sequence that connect the empirical data to a study's initial research questions and ultimately, to its conclusion.[54] In order to get a high

[52] Trost, 1994

[53] Ekholm & Fransson, 1994.

[54] Yin, 1994

quality of the empirical study when conducting an investigation, the researchers should consider different criteria for evaluating the collected data. There are two central concepts that have to be taken into consideration: reliability and validity.

Validity

Validity refers to whether the researchers have the correct operational measure for the concepts being used.[55] In order to ensure construct validity, multiple sources have been collected. According to Yin, there are four types of triangulation to increase the validity of a research paper. These four different types of triangulation are data triangulation, investigator triangulation, theory triangulation, and methodology triangulation. We use multiple triangulations to increase the internal validity of the thesis. In the research, we sent out the questionnaire to 30 Swedish companies and to 20 British companies, which include manufacturers and road transport providers. Further, we used multiple sources of information, confirming the data from both the SNRA and DfT. Additionally, we have also discussed the thesis with representatives from the SNRA. Therefore, we believe that our thesis has a high degree of internal validity.

According to Merriam, external validity is concerned with to what extent the findings from the research are applicable to other situations, beyond the specific case study. The requirement for this is that the work has a high degree of internal validity. Otherwise, there is no point in generalizing the findings. If external validity is obtained, the result of the research can be transferred and applied to other studies within the area.[56] The meaning of this is that other organizations rather than the SNRA might benefit from the result. One advantage of this research is that more than one case has been included. Multiple case studies increase the external validity level of the research. Additionally, we believe that the reader can get an understanding from Chapter two and Chapter Three of what kinds of environmental influences that road

[55] Yin, 1994

[56] Merriam, S. 1998

transport can generate and how to reduce these impacts by implementing various environmentally friendly solutions and regulations.

Reliability

Reliability refers to what extent the results would be the same if the study was repeated given the same circumstances. Therefore, it measures the ability of the method to be accurate and consistent.[57] This creates a problem in social science, since human behavior changes with time and sometimes also with the individual. Yin suggests that the creation of a formal project database containing all the data will increase the reliability, by having the evidence available for other researchers. We have accumulated all collected data with the objective of allowing other researchers to easily review the findings of our study. Furthermore, we collected data from multiple sources to make sure that the findings were not subjective. Finally, we took a number of precautions in order to increase the reliability of the research. For example, all the answers of questionnaire we received from companies were presented anonymously. It can enable companies to answer the questionnaire without any hesitation.

[57] Winter, 1987.

5 The Benchmarking of the SNRA & the DfT

This chapter will start with findings of different programs and objectives within the SNRA and DfT, and finally a comparison from the conducted case study will be presented.

5.1 The SNRA

5.1.1 Benchmarking of different programmes

The first national environmental program was established in 1996 in Sweden. This program emphasized the support of other players so that they could contribute to the environmental goals. After 1996, seven regional environmental programs have been drawn up.

The environmental programs of SNRA described the common ambition at the national level and aim to fulfill the goals of government as well as SNRA. The program applies to three of SNRA's main tasks: sectoral responsibility, the exercise of public authority and national road management. The program also concerns strategic planning measures and common measures within the organization, however, the measures are not linked to any specific main task.[58]

During the program period, the SNRA will mainly focus on the following areas:

1. To attain environmentally – sound, energy- efficient and safe transportation, the SNRA will help the business and public organizations to develop a market for procurement, implementation and follow-up of transport services.
2. Continue to implement and promote an EcoDriving style with driving school, see Appendix 2: EcoDriving.

[58] National Environmental Programme 2002-2005, 2001

3. To contribute to the development of a national strategy for non-fossil fuels.[59]
4. Start co-operating in the road transport areas with regional and local players. The SNRA will develop and implement measures in consultation with public administration, industry and stakeholder organizations.
5. Start co-operating with other players and find a measure to solve the health problems, which result from harmful emissions of road traffic.
6. To draw up goals, define indicators and carry out measures to protect and preserve environments of natural and cultural value in urban and rural areas.[60]
7. Reduce the noise level to 30dBA maximum, equivalent to a level indoors in dwellings.
8. By continually developing the procurement and reimbursement model within national road management, reviewing the civil works code and monitor adherence to it, the SNRA plans to develop environmental management in construction, operation and maintenance.
9. Improve the basic conditions of walking, cycling and public transport.

Furthermore, the SNRA sets the environmental goals at two levels during the program period. The overall goals for the entire organization and the detailed goals relate to the SNRA's main tasks and those working on them. The SNRA's overall goals areas are the following: [61]

1) By implementing several measures to reduce the carbon dioxide emission by 130 000 tons.
2) Environmental quality standards for air along the state road network are to be met from the years when they are stipulated in legislation and regulations.
3) Properties along the state road network where the noise level exceeds 65dBA out-doors are to have maximum 30dBA equivalent indoor level.
4) Concerning natural and culture environments along state roads, goals and strategies should meet the criteria.

[59] National Environmental Programme 2002-2005, 2001
[60] Ibid
[61] Ibid

To ensure the environmental laws and regulations are being complied with the organization, the SNRA is working on introducing and improving its environmental management system. This system connects Environmental Policy, Planning, Implementation and Operation, Checking and Corrective Action and Management's Review, and integrates them with other activities.

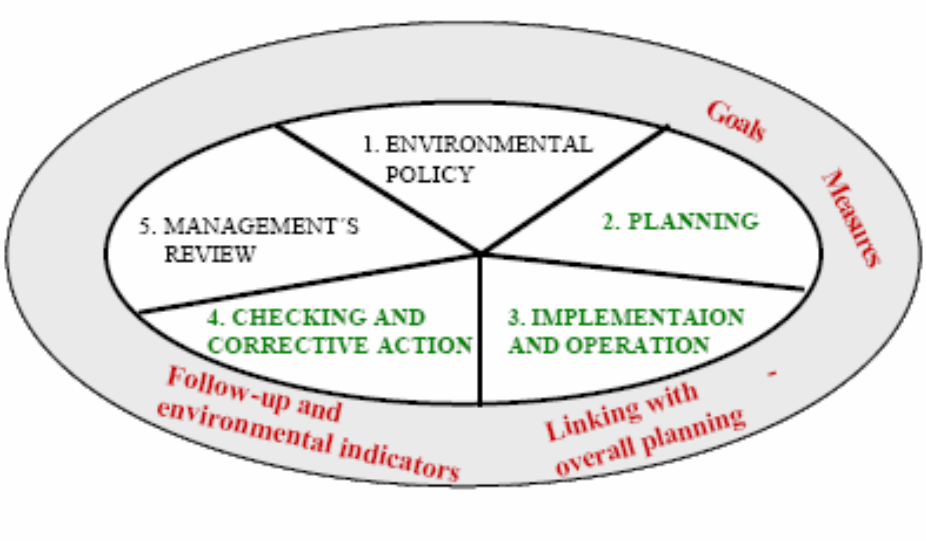

Figure 4: The SNRA Management System

The environmental program is concerned with "Planning", "Implementation and Operation", and "Checking and Corrective Action". Within "Planning", the program sets environmental goals and describes measures. Within "Implementation and Operation", goals and measures are linked with overall planning. A follow-up system is included in "Checking and Corrective Action"[62]

5.1.2 **Environmental Impact of Road Transport in Sweden**

In Sweden, different laws, policies and regulations have been promulgated to control the logistics deals with the environment. In order to control the environmental quality within the road transport sector, the SNRA also established several long-term goals for itself.

- In 2010, to keep carbon dioxide emission from road traffic at the same level as in 1990. Compared with 1995, reduce Nitrogen Oxide emissions

[62] National Environmental Programme 2002-2005, 2001

by 40%, for sulphur by at least 15% and for volatile organic compounds by at least 60 by 2005. Level of carbon monoxide, nitrogen dioxide, sulphur dioxide, soot and particulate matter in built-up areas will be below the limit values and established environmental quality standards. Emissions of carcinogens are to be halved by 2005 comparing with 1998.

- No resident shall be exposed to road traffic noise exceeding 65 dBA with equivalent outdoor by walls by 2007. Along state roads, this goal will be achieved by 2005. Where outdoor levels cannot be reduced to 65 dBA, the focus is to be that levels indoors are not to exceed 30 dBA equivalent levels.

- Environmentally hazardous materials should not be introduced into the infrastructure, the use of non-renewable materials shall be minimized, and material will be recycled.

- New transport facilities are to be situated so that they work in harmony with their surroundings, and are to be designed taking into consideration local natural and cultural heritage.[63]

Compared with 2001, different emissions have been reduced except carbon dioxide. Due to the dramatic increase in the use of cars and heavier vehicles in 2002, carbon dioxide emissions have increased by 2 % and petrol consumption has also increased compared with previous years. By the end of 2002, carbon dioxide emissions have increased by 9 % from 1990. It looks very difficult for the SNRA to achieve the interim goal.

The SNRA does not have any continuous monitoring of persons exposed to noise on local authorized roads. However, the SNRA and other local authorities estimated that the total number of people exposed to noise has not fallen during the year 2002.

[63] Annual Report, Swedish National Road Administration (SNRA), 2002

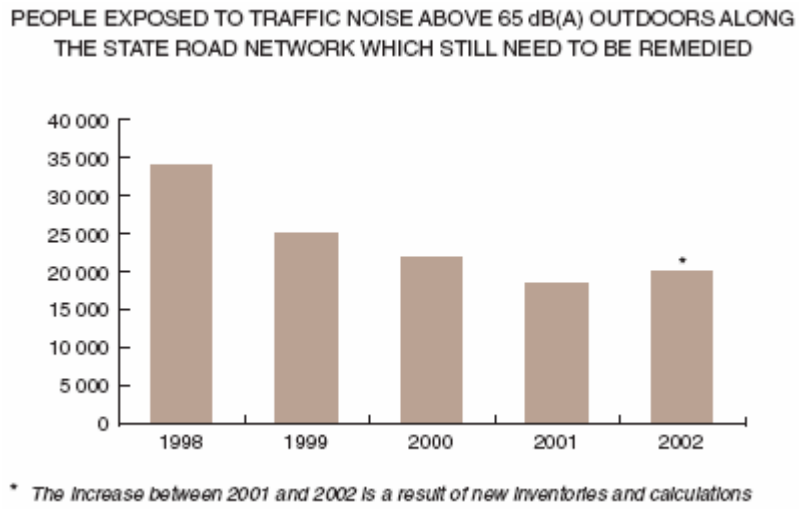

Diagram 1: People exposed to traffic noise above 65 dBA

5.2 The DfT

5.2.1 **Benchmarking of different programmes**

In the UK, the main objective of the DfT is to provide a strong focus on delivering the Government's transport strategy, which is very similar to the SNRA's goal. The role of the centre of the DfT is to set strategy and policy context as well as to establish and manage relationships with the organizations that are responsible for delivery transport services.

The DfT has six executive agencies that are central to delivering the Government's transport priorities and services. These are:[64]

- Driving standards agency (DSA)
- Driver and Vehicle licensing agency (DVLA)
- Vehicle Certification agency (VCA)
- Vehicle and Operator Services agency (VOSA)
- Highways agency (HA)
- Maritime and Coastguard agency (MCA)

[64] About the DfT Executive Agencies, 2003

In developing a new structure for the DfT, an important priority has been to strengthen the role and position of the agencies, ensuring that they are completely engaged in shaping as well as delivering policy.

The DfT's objective is "transports that work for everyone" and in order to achieve the objectives, the DfT works in partnerships with others to:

- Tackle congestion
- Improve accessibility
- Reduce causalities
- Respect the environment and
- Support the economy.

According to the DfT, well-planned transport links for moving people and goods are a necessity to a successful and growing market. The DfT plays a key role in meeting these demands by providing the strategic framework for the delivery of transport services and by planning for future transport needs.

As mentioned in the theory and research chapter, the British government is taken proactive actions to tackle these demands. For example, introducing programs such as, "fair pricing" and strategies which offer financial incentives for companies that use environmentally friendly fuel.

Furthermore, the transport policies are also important contributors in meeting government priorities, for instance, protecting the environment, fostering social inclusion, improving productivity, promoting economic growth, and modernizing of Government services. The DfT aims to be outward looking, fully involved in developing the wider Government agenda.

The DfT achieves its objectives by working in partnership with a wide range of public and private sector bodies. The nature of the different relationships differs vastly between each relationship. The level of control the DfT can exercise differs from case to case. The DfT funds some; however, responsibility for providing the service lies with the agency. In some cases, the DfT's role is

something like a stakeholder, where most of the funding comes from the private sector.

However, in most of the cases, the DfT remains responsible for the overall delivery of the Government's transport policy and strategy, as well as for ensuring transport is properly aligned with other Government objectives. Furthermore, the DfT's mission is to influence the way in which services are delivered and improvements are planned in order to achieve the Government's objectives.

5.2.2 **Road Transport volumes in the UK**

As a developed country, the UK has an advanced road transport system, however the problem related to the environment from the road transportation sector also exists.

Over the past ten years, the total value of economic output in the UK has increased by 20 % and the major growth is in the service sector. From 1980 to 2001, the amount of freight increased by 42 %, from 175 to 248 billion tone kilometers. The most significant increase occurred in the road transportation sector. The increment was 69 %, based on 1980 level, from 93 to 157 billion tone kilometers.[65] In this period, the total number of heavy lorries registered in the UK has not changed, but if measured by the number of tone kilometer transported, the increment of heavy goods vehicle traffic on roads in the UK is 38 %. The total vehicle kilometer of van traffic in the UK has increased by 40 %.[66]

5.2.3 **Environmental Impact of Road Transport in the UK**

Development, which benefits transportation, most often results in a substantial environmental impact. By the end of 1997, there was no increase in the number of lorries in the UK, but if compare it with 1987, average transport ability per lorries has increased and van traffic has also increased substantially. The National Road Traffic Forecast pointed out that the growth from 1996 to 2006

[65] Transport Trend 2002: Articles, DFT, 2001

[66] Sustainable Distribution: A Strategy, DFT, 2002

in lorries will increase by 16 % and van traffic by 29 %, rising to 25 % and 44 % above the level of 1996 by 2011.[67] The government already has made efforts to solve the problem, which related to the road transport. For example, substantial improvement in fuel economy and emissions performance have been achieved in the latest generations of vehicles, which will continue to reduce pollution for a number of years to come as older vehicles are scrapped.[68] However, the increasing demand for road transport would threaten the government's environmental endeavors. Especially in urban area, the transport emission has become the dominant source of air pollution emission. The growth in transport can also result in the increase of greenhouse gas emissions, which can lead to increased global warming. The congestion in some urban areas is also an unsolved problem to the British government.

Since carbon dioxide is the largest contributor to green house gases, which is a global problem, the UK government has a public Service Agreement (PSA) target on greenhouse gas emissions, which should reduce the carbon dioxide emissions by 20 % before 2011, based on 1990 levels.[69]

During the years of 1980-2000, emissions of CO_2 from transport end users increased from 28 to 37 million tones of carbon. Due to the technological improvement and the use of cleaner fuels, levels of CO_2 emissions from road transport have a slow growth rate from 1990 to 2000.[70]

Most environmental impacts from road transport are related to the energy consumption. Since 1981, there is an increase of energy consumption by transport in the UK. The total consumption of fuel has increased from 34 to 55 million tones, and is equal to a 62 % increment.[71] The main increase is in the road transport sector, but due to the use of new generation vehicles, the fuel consumption of road transport has remained stable from 1991 to 2000.

[67] Sustainable Distribution: A Strategy, DFT, 2002
[68] Ibid
[69] Transport Trend 2002: Articles, DFT, 2001
[70] Ibid
[71] Ibid

5.2.4 **The UK – Fair pricing program**

A sustainable market is more than just an open market. In a sustainable market, decisions are taken in recognition of their wider impact and decision-makers act responsibly with respect to society as a whole. In order for this to happen, it is important that the market should inform decision-makers as to the wider costs which they incur in making their decisions - and not only those costs which bear upon themselves directly.

A substantial element of distribution costs is typically "internal" to the buying transaction and therefore taken into account as a matter of course through the operation of the market. Therefore, the purchaser or operator of road transportation services must consider all the labor, fuel, vehicle depreciation and maintenance costs (including taxes) which make up to the bill for transporting goods from A to B.

However, in reality the costs do not end there. In the process of transporting goods from A to B, a vehicle consumes road space which itself has a cost. It contributes to wear and tear, which will eventually necessitate expenditure on maintenance of road surfaces and structures, or congestion incurred by other road users. Road traffic is a substantial cause of deaths and injuries, which impose heavy costs on society. Some of these costs do reflect on the operator or the purchaser of transport services, for example, through insurance premiums and through taxation to fund public expenditure on road building and maintenance. Nevertheless, they are not completely reflected, nor are they always directly apparent.

Then there are the "external" costs. These costs include the impact of vehicle emissions on air quality, public health and climate change. Almost everyone is affected in some way by noise and congestion on crowded roads and city streets, including car, van and lorry drivers themselves. Typically, these costs are not directly apparent to the transport purchaser or operator, at least not in the short term.

The government can promote fair and transparent pricing through taxation. The British Government has adopted a strategy of annual increases in fuel duty of at

least 6 % on average above inflation and is committed to moving towards a fairer treatment of petrol and diesel, when calculated on an energy or carbon-content basis. These are significant steps towards reflecting the wider costs of road transport in the prices which users pay.

The government recognizes the transportation industry's concern that the fuel duty escalator makes fuel more expensive in the UK than in other EU countries. However, the fuel duty escalator is the best way to encourage fuel efficiency, for which there remains plenty of scope. It is also only one factor in transportation costs, although an important one; the UK transportation companies do benefit from more favorable company taxation and social costs than in many other EU countries.

The government can also offer financial incentives. To reflect concerns over air quality, the 1998 Budget increased the differential between ordinary diesel and ultra-low sulphur diesel to 2 pence per liter, which means that ultra-low sulphur diesel is cheaper than ordinary diesel. Additional, the Government announced a commitment to increase this again, to 3 pence per liter, at the next Budget.

However, while it is easy to say that pricing should be "fair" in the widest sense, it is more difficult to pin down what "fair" really means. It is known, for example, what the total cost of building and maintaining roads is, but it is not a simple matter to attribute elements of that cost to broad categories of vehicles. Quantification of some of the wider "externalities" (such as the costs of noise or pollution) is more difficult. Different approaches to estimation (e.g. "willingness to pay" vs. "mitigation cost") can produce substantially different figures.

Nevertheless, progress can be made towards taking proper account of these costs through the tax system. As part of the last budget, the Government announced a wide-ranging review of the system of setting Vehicle Excise Duty (VED) rates for Lorries, to reflect the environmental damage, which they caused. To assist in this review, the Government has commissioned further research, with the aim of developing cost estimates which command greater confidence both in the industry and in the community. Better information

should help to promote informed policy development at the EU as well as national level.

Another important mechanism for promoting fair markets is regulation, which directly 'internalizes' external costs by requiring industry to meet particular standards. The British Government supports the European Commission's Auto-Oils program, which seeks to bring about improvements in air quality through progressive reductions in vehicle emissions and improvements in fuel quality. Regulation has also played a strong role in improving the safety of vehicles through design, driving standards requirements and the requirements laid down for vehicle operation.[72]

5.3 Discussion of programs of the SNRA and the DfT

One of the difficulties facing the SNRA as well as DfT is the increasing use of road transportation. In order to cope increasing transportation demand, the SNRA has established a number of programs and plans, both for the environmental situation and for the community. At the same time, the SNRA is working on improving its environmental management system. From the SNRA's point of view, these plans and programs can ensure the environmental laws and regulations are implemented into the companies. However, many of SNRA projects are political. Due to the high degree of political involvement, the implementation processes of new proactive actions are very time-consuming and bureaucratically driven.

During the research process, it has been very difficult to find information regarding various process assessments such as implementation of environmental regulations and policies. This might be the case because of the high level of political involvement. The research outcome would be more interesting if one could involve more explanatory data regarding environmental implementation projects within the SNRA on a more detailed level.

[72] Fair and efficient pricing, 2001

It seems that the UK government has taken on a more proactive strategy in order to cope with the rapidly increasing road transportation. By successfully introducing Fair Pricing in the UK, the government expects to leverage the competition between the different modes of transportation. Another successful strategy is to work in close partnership with private investigators.

The SNRA is also working with private companies; however, the project is still in its cradle. By closely examining these kinds of successful projects, the SNRA could obtain valuable experiences.

The only way of facing the future demands is to act strongly and consistently in co-operation with practical strategies. When comparing the SNRA and DfT work with environmental questions, the DfT seem to have more practical experience than the SNRA within the area of projects such as implementing of environmental programs. For example, the DfT offers companies financial incentives for using environmentally friendly fuels. The Swedish government's involvements might be acting as a "bottle-neck" for the SNRA. However, due to limited data sources, this kind of conclusion is dangerous to draw. As mentioned before, a more detailed research within the area of environmental work has to be done in order to draw proper and reliable conclusions.

The information we collected from the SNRA and DfT assist us understanding the environmental issues that related to road transport sector on the governmental level. We collected the data from companies through the survey in chapter 6, which can show us the information on organizational level. In chapter 7, a more detailed analysis will be carried out by involving both the private industry as well as the government actions.

6 Industry Responds

In this chapter, the results of the survey will be presented. The respondents' answers will be discussed. For further information regarding the analysis and conclusion, we refer to chapters seven and eight.

6.1 Preface

In order to give an answer to our purpose, we decided to conduct a survey. The questionnaire deals with questions that connect logistical activities and environmental actions and programs within various companies. In order to have a clear structure, we decided to present the results by following the same structure as the Appendix 1: The Questionnaire. The first section deals with the type of company and the position of the respondents.

1. Different types of studied companies and countries (Table 6.1).

Country	Transport Provider	Manufacturer	Other
Sweden	55 %	32 %	13 %
The UK	54 %	39 %	7 %

From table 6.1 we can clearly see that the main population consists of transportation providers. As mentioned in the methodology chapter, we wished to have even percentage of the different lines of businesses. However, the answers derived mainly from transportation providers and manufacturers. The uneven answers from different types of companies could be that the questionnaire was too concentrated on transportation issues, such as transportation providers, the rest of the population did not find the questionnaire interesting enough to answer.

The result from the "others" consisted of wholesalers from different lines of businesses, such as food and clothing industries.

2. Respondents' position and responsibilities.

The majority of respondents consisted of mangers within the Logistics- and Environment departments. This ensures the reliability of answers, which we received, from companies. We believe that persons in those departments can provide more precise and reliable information for us. Further, we received some answers from other departments, such as accounts receivable, financial and purchasing departments. These persons are important for our research as well; by involving other departments in the research, we believe that the result could become more extensive.

6.2 Environmental Policies and Regulations

The purpose of these questions is to acquire a deeper insight of the companies' opinion on environmental policies and regulation and the implementation of those policies.

3. The degree of the importance of environmental policies (Table 6.2).

Country	Very Important	Important	Of small importance	Insignificant
Sweden	95 %	5 %	0 %	0 %
The UK	85 %	15 %	0 %	0 %

When we talking with the SNRA, they mentioned that almost all manufacturers and transport providers have their environment policies, which should agree to government transport policy. As the first question from table 6.1, which relates to environment issues, the purpose from question 3 is to get an insight in how important the environmental question is within companies today. By asking this, we believe that it will be easier for us to get an overview of what companies' opinions are regarding environmental issues. Furthermore, we could find out if there is huge difference between companies from two countries. As illustrated in the give table above, 95 % of Swedish companies

and 85 % of British companies considered this question as a very important issue for them. The most positive result is that there no company, both from the UK and Sweden, deems environment issues as insignificant.

4. The degree of employees' acceptance concerning the company's environmental policies (Table 6.3).

Country	Yes, fully accepted	Yes, partially	No	Uncertain
Sweden	18 %	41 %	0 %	41 %
The UK	31 %	46 %	0 %	23 %

In order to reduce environment impacts from road transport activities, it is very important for companies to implement environmental policies into all levels of companies' business activities and to require all employees to follow the policies in the operation. In table 6.3, two respondents answered that they believe the policies are fully accepted, but "not always being followed!" To compare with Swedish companies, there is a higher percentage rate from the British companies' answers that they believe the environmental policies have been fully accepted. However, the "Uncertain" answers from Swedish companies show that policies may not have been fully distributed throughout the organization.

6.3 Environmental Goals and Action Plans

The following section deals with companies' willingness to achieve the internally environmental objectivities. Further more, we want to find out if there existed any actions plans in connection with the environmental goals.

5. What goals have been established through out the organization (Table 6.4)?

Country	Yes, please give an example	No	Uncertain
Sweden	86 %	0 %	14 %
The UK	62 %	0 %	38 %

Those companies who answered "Uncertain" may have misunderstood or it may have been poorly formulated. The ones that answered "Yes" mentioned different goals, such as:

- Increase usage of environmentally friendly fuels.
- 5 % reduction of CO_2 emission.
- By compressing waste, the company needs fewer transports.
- Reduced pollution from our cars.
- Decrease usage from CO_2, SO_X, NO_X and PM emissions with 5 % per tone km.
- Decrease road mileage and use of heavier trucks.
- Reduce generated road kilometers through increasing usage of intermodal transport.
- Switching transport mode, decreasing the use of road transport by 25% by utilizing rail transport by adopting intermodal policies.

The major part of the respondents, both the Swedish and the British companies, in table 6.4, mentioned that their main goals were to reduce CO_2 emission and other hazard emissions. We cannot explain why the answering rate was lower for the British companies.

6. The goal achievements are listed.

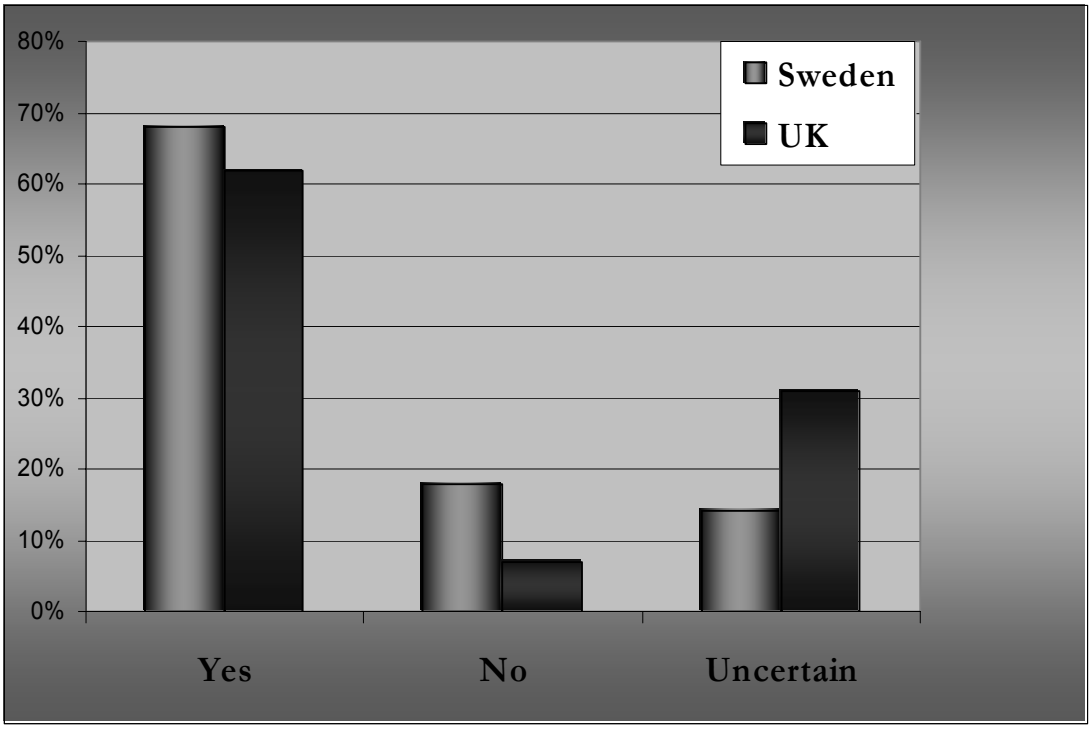

Diagram 2: Environmental goal achievements 2003

In total, 68 % of the Swedish companies and 62 % of the British companies believe that they achieved their environmental goals in the year 2003. The reason for the high percentage of Uncertainty might be the nature of measuring the goal and its intangibility, as a total of 31 % of the UK companies answered that they were uncertain.

7. If the companies would continue strive to improve themselves after achieving the environmental goals (Table 6.5).

Country	Yes	No	Uncertain
Sweden	68 %	0 %	32 %
The UK	69 %	0 %	31 %

From Table 6.5, we received similar responses from Swedish and the UK companies. About 68% of Swedish companies and 69% of the UK companies

said that they would continue improving their environmental work in 2004. The rest of the companies did not provide a certain answer on this question; however, no companies in either country said they would not improve next year.

8. Action plan in connection with the company's environmental policies and the activities involved (Table 6.6)

Country	Yes	No	Uncertain
Sweden	82 %	13 %	5 %
The UK	54 %	15 %	31 %

The percentage of answers "Yes" in Table 6.6 is 82 % from Swedish companies and it is much higher than the percentage of "Yes" answers from the British companies. Numerous Swedish companies said that they have an "action plan" which involves several steps and those steps are further divided into different divisions within the company. Within each division, much effort is placed on continuously developing themselves to become more effective and efficient manufacturer. Waste management, reversed logistics, return loading and packaging/handling are some activities which are under constant development. For the moment, their exist problems of coordinating these divisions and activities efficiently, but effort is being made to improve the processes.

Three manufacturers mentioned when purchasing transport, they plan to include the environmental impact as well as the price and the quality into the decision making progress.

6.4 Technological research and solutions

It is very interesting to see what kinds of technological research and solutions exist on the market today. Further more, we want to discover what environmentally friendly innovation and solutions could be use in the future

and if it is possible for the SNRA to promote this in front of the government and therefore become valuable.

9. Research and development on logistical solutions conducted by companies (Table 6.7)

Country	Yes	No	Uncertain
Sweden	68 %	25 %	7 %
The UK	69 %	31 %	0 %

Almost 70% of both the Swedish and the British companies are conducting research or development on logistics solutions. However, we did not receive the detailed information about their research and development. Some respondents answered that some projects were classified for the moment; however, continuous development within the area of environmental does exist.

Some examples regarding research of logistical solutions are:

- Improve diesel engines.
- Improve catalytic converters.
- More use of on-board communication equipment.
- Improve the aerodynamic design of vehicles.
- Develop more efficient and economical bio fuel engines.
- Support “financially” different universities in research projects.
- Simulations in house, and different traffic planning system are carried out continuously.
- Alternative for fossil fuels.

10. New trends emerging within their line of business (Table 6.8)

Country	Yes, namely	No	Uncertain
Sweden	100 %	0 %	0 %
The UK	100 %	0 %	0 %

All answers we received from the companies have the same answer; they have noticed new trends emerging in their line of business, such as:

- Movement of production closer to the customer.
- Increased use of consolidation of freight goods and joint loads between companies.
- Increased use of intermodal transport, most economical point of dispatch.
- "Mobiler", 44 m^3 tank containers with side unloading capability, when transporting liquid freight.
- Increased use of diesel engines, negative impact on the industry.
- Declining price for purchasing transports, increased competition within the freight industry.

11. Technological or other innovations the companies are using today or planning to use (Table 6.9)

Country	Yes, namely	No
Sweden	100 %	0 %
The UK	100 %	0 %

Most of the respondents mentioned "new technology in developing more efficient engines" reducing the emissions and consuming less fuel. Very popular seems to be bio fuel trucks and alternative fuels, but at present the techniques are not satisfactory enough, which both Swedish and British companies answered.

One global manufacturer, located in the UK, mentioned that introducing their own container terminal and using "floating storage" would increase the insight into their internal processes and by that, increase efficiency.

New planning systems such as route-planning, ordering systems, consolidation of goods and GPS system were mentioned by a number of transportation providers.

12. The benefits of using these innovations.

Almost all respondents mentioned "customer satisfaction" as a major advantage and benefit by utilizing more environmentally friendly innovations and related technology. The survey confirms that being seeing as an environmentally friendly organization is of great importance today. It is shown by the number of respondents that reducing cost is also a great benefit by using more innovations. Several global companies consider themselves to have the duty to serve as a raw model for other companies, the larger organization the greater influence on smaller organizations they will have.

A transportation provider declared that it is possible to lower the gross transport work and reduce the environmental impact by using better and improved planning systems and by trying to achieve better utilization of available resources and consolidation of goods within and between companies. The respondent mentioned today's load factor is approximately 40 – 60 percent; however, by consolidating and planning strategically, it is possible to reduce environmental impact by half.

6.5 Buyers' Consideration

In order for the SNRA to take correct actions to influence the buying behaviour, it is important to discover the underlying motives of the buyers' opinion when purchasing transport services.

13. Important features when selecting a transportation provider.

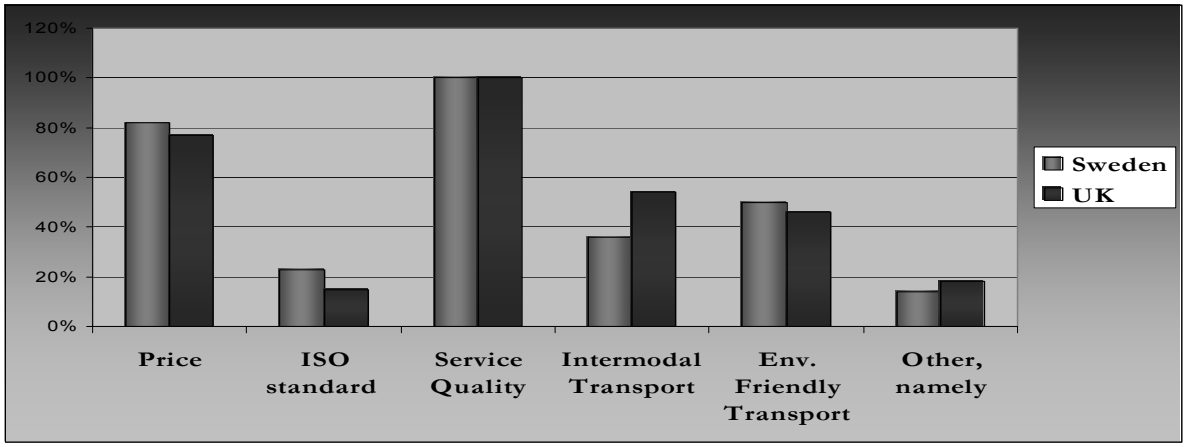

Diagram 3: Buying criteria

The most important feature for a company is the Service Quality. All companies from both countries selected service quality as the most important feature when selecting a transportation provider for their company. There are 18 % of the Swedish companies and 23 % of the British companies, who did not consider the importance of transport price when they choose a road transport provider. Optimistically, half of the Swedish population answered that Environmentally Friendly Transport is an important criterion for them. However, we expected that we would receive a higher response for the alternative "Env. Friendly Transport" from both countries than we did. Further, we see a trend towards increasing use of intermodal transportation.

We believe some respondents most likely misunderstood this question. It is plausible that the knowledge of what ISO-standard means has not reached the respondents or has not being clarified on our behalf. Looking reflectively, we believe that an explanation would be in order for this alternative.

In the alternative, "other namely", many respondents answered, Time precision as one of the most important features. A further important feature was to have an established and good relationship with each other. Without solid relationships, the respondents meant that collaboration is difficult to establish and as a result, declining efficiency and effectiveness.

14. Transport mode choice (Table 6.10)

Country	Road	Sea	Rail	Air	Intermodal Transport
Sweden	41%	9%	27%	0%	23%
The UK	38%	15%	16%	0%	31%

Road transportation is the majority model in the UK and Sweden: approximately 41 % of Swedish companies, and 38 % of British companies. The second transport modal in the UK is intermodal transport, where 31 % of the respondents from the UK choose intermodal transport. Rail comes in second place with 27 % for Swedish companies.

15. Intermodal transport as a solution (Table 6.11).

Country	Yes	No
Sweden	59 %	41 %
The UK	85 %	15 %

From table 6.11, we can clearly see that using intermodal transport as a solution, as companies both in Sweden and in the UK are considering use in the future. It is interesting to see is the huge different between the two countries in answering. The number of "Yes" answers, consider using intermodal transportation in the future, is totally 26 % differ between two countries. The percentage of Swedish companies that did not plan to use intermodal transport in the future is higher than in the UK.

16. Negative or positive experiences from the work of the SNRA and the DfT (Table 6.12)

Country	Positive	Negative	No Response
Sweden	64 %	0 %	36 %
The UK	23 %	0 %	77 %

We did not receive any explanations for this question, as shown in above give table; more than half of the Swedish population experience positive effects from the work that the SNRA is conducting today. One reason for this outcome could be that it is too difficult to explain or too time consuming to answer. Few British companies mentioned, "New working time directives are most probably increasing their transport cost". However, we do not consider this as a problem, but rather positive from a society point of view.

17. Companies' suggestion for the SNRA.

A large portion of respondents did not answer the question. It might be the question was too complicated or time consuming. In total, 82 % of the Swedish respondents did not answer this question. However, some companies asked for more controls along the roads, for example, more alcohol, speed, and goods security controls.

One respondent answered that subsidies of new techniques such as bio fuel engines should be implemented. This is largely due to the fact that, today it is too expensive to use available environmental friendly techniques.

7 Analysis

In this chapter, the results from the conducted survey in chapter six will be analyzed and an analysis of the benchmarking of the SNRA and DfT will be carried out.

7.1 Environmental Policies and Regulations

From our conducted survey, we can see a strong commitment to and increased awareness of environmental related issues within organizations. It is important for companies to have environmental policies and guidelines for how to act accordingly to government environmental policies and regulations. We believe it will become even more important in the future to act and think "green" on the behalf of organizations. 95% of the Swedish companies agreed that environmental policies are very important and should be taken into consideration at all levels of company's logistics activities. Therefore, we believe it will be easier for the SNRA to introduce new and strict legislation for environmental regulations. Several companies agreed that more traffic, alcohol and goods security controls should be present in order to increase the road transport safety. The environmental policies and regulations within organizations and on national level have to be consistent with each other, which means the government should consider whether it is possible for companies to accept the new environmental regulations and put them into operation.

We believe implementations of regulations are very important for securing sustainable development. Further important measures are to reach a higher level of integration between various transport modes in order to reduce environment impacts. Central is the integration between the SNRA, government and industry. The SNRA has some projects going on today with freight transportation companies, but it is yet in the cradle, and much work has to be done.

On the other hand, it indicates that environmental policies within companies are also very important, but when asking if the policies have been accepted, the majority of the Swedish respondents are uncertain or partially has not been

accepted. Nevertheless, there exists the intangibility in the measurement; it also indicates that the implementation of environmental policies could be somewhat unsuccessful. Why the UK respondents' acceptance to environmental policies is higher could be that the company or the government has succeeded in the task of promoting the importance of environmental questions throughout the organization. We believe that proper measurements and actions should be taken in order to co-operate with the complexity when implementing environmental policies. As mentioned in chapter 3, using systematic methods and standards will increase the possibility of successful implementation.

7.2 Environmental Goals and Action Plans

When analyzing the environmental goals, goal achievements and plans regarding environmental goals, it seems that most Swedish companies have clear goals in connection with the company's environmental policies. The majority believe that the environment objectives will be achieved by the year 2003. To ensure that both the government and companies can achieve the environmental objectives, linking government goals with companies' environmental goals and establishing common objectives should be the objective for the SNRA.

In Diagram 2, the high rate of uncertainty is according to both the Swedish and the British companies, due to the intangibility and complexity in measuring exactly "when" the environmental goals can be achieved. Another reason is the fact that stills are seven more weeks before the end of the year as of the time when the survey was made. Due to the difficulties in finding relevant data regarding changes of environmental parameter, audits are needed for developing new and more accurate measures. The companies are planning to improve themselves after achieving present objectives by introducing new and more accurate measures.

In order to achieve their objectives, companies mentioned technologies and methods such as increasing use of environmentally friendly fuels, reducing the emissions of CO_2 and switching transport mode to more environmentally friendly mode and reducing road transport. As seen in chapter 3, varieties of

different methods are presented. Section 3.2 illustrates methods of how to reduce road transport usage by adopting methods such as intermodal transportation, which recommend more usage of rail and sea transportation. Transportation provider could also reduce CO_2, SO_X, NO_X and PM emission by driving in an EcoDriving style, as illustrated in Appendix 2: EcoDriving. The illustrations mentioned could be a helpful indicator for the SNRA to better assist Swedish companies in achieving their goals and acting as a middle hand, thereby increasing the communication between the government and the private sectors.

One reason why Sweden has higher rate of negative answers regarding goal achievements in question 6, might be that the environmental goals could be dissimilar between the countries, companies, and lines of businesses. In Sweden, work on improving the environmental situation has exist for a longer time, and the demands might be higher than in the UK. That is why the answering rates could differ somewhat.

Results indicate that adopting environmental policies, acting "green" and implementing sustainable programs, are highly trendy today. Regarding the question of companies' "action plan", we noticed that numerous companies have an "action plan". 82 % of the Swedish companies and 54 % of the British companies pointed out that they have constituted an "action plan" in connection with the companies' environmental policies. As written in section 3.5, if information could be distributed throughout the organization, it might be easier to succeed in connecting an "action plan" with the environmental policies. We believe by creating a symbiosis relationship between various activities and environment, different divisions assume total responsibility for their actions. Therefore, various impacts could be traced back to the source, and responsible actors or activities could result in an effective and efficient "action plan".

There is 26 % percentage (table 6.6.) difference of "uncertain" answer between the British companies and the Swedish companies. We believe that there are two reasons which cause this difference. The first one is because there is no specific action plan connecting to environmental policies in these British companies. The second reason is the lack of appropriate explanation regarding

the reference to the "action plan". When we sent out the questionnaires, the respondent might not have fully understood the meaning of the question when they answered it.

7.3 Technological research and solutions

We found that 68 % of the Swedish companies and 69 % of the British companies did conduct research and development within logistical solutions. The high rate of "No" answers comes from small or medium size companies, which is due to limited resources. Approximately 30 % of the respondents' research and development programs consisted of providing financial aid to universities within the area of environment and transportation. Nevertheless, the majority of companies are conducting different levels of research regarding technology and logistical solutions, such as improving diesel fuel, alternative fuels, intermodality solutions, and development of more efficient and economical bio fuel engines.

All the respondents agreed that there are constantly new trends and technologies emerging within the transport industry, alternative fuels, intermodal transportation are some examples. Regarding the usage of new technology, we detect parallels between theory and practice, section 3.2, such as consolidation of freight goods, joint loads, intermodal transport, and decreasing usage of diesel engines.

By using consolidated techniques in a smarter manner, as mentioned in Question 12, it is possible to reduce the environmental impact by 50%. Further reduction in vehicle kilometers are possible, however, by increasing the load factor by 50 percent, the fuel consumption will increase somewhat, but still will be better, both for the environment as well as for the economy of the company. However, the consolidation of freight within and between companies can lead to disadvantages, for example, the service level will decrease somewhat.

The major part of both populations mentioned "customer satisfaction" as the main advantage by utilizing new technologies and innovations. From a marketing perspective, it seems being perceived as an environmental friendly organization is of great importance. From our theoretical research, we can see

clear parallels with section 3.3. One should be aware that "everybody" wants to be seen as an environmentally friendly organization. However, from our survey, it is impossible to examine and decide to what extent the companies are actually working with environmental solutions.

From the survey, we can see there is a growing interest in alternative clean fuels for transportation. This is mainly due to the long-term need for alternatives to non-renewable resources in transportation and the need for tighter regulations to improve the environment. For example, compressed natural gas is available and ready to put in to use. Encouraging research and development of the compressed natural gas and the support from government would make it more commercially attractive. All new technologies and environmentally friendly alternatives require heavy investments in both infrastructure and equipment, such as new vehicles and facilities. Without any proper market demand, there will not be any suppliers willing to do the necessary investments.

7.4 Buyers' Consideration

The most important aspects to transport service buyers, when considering buying service, are the price, delivery time, service quality and other important features. Transport providers, to become more competitive, must consider improving all criteria of concern to service buyer's characteristics.
As seen in depicted diagram 4 from table 6.10, road transport is the mode companies mainly use.

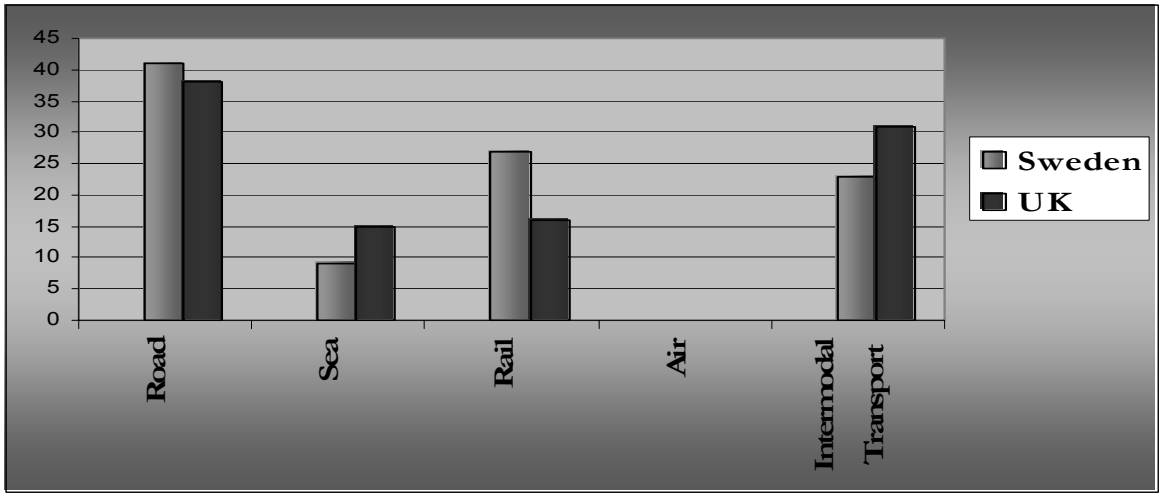

Diagram 4: Transport modes mainly used by Swedish and British companies.

This is due to the road transport's shorter delivery time, higher service quality and lower price when compared with other transport modes. However, the government has the power to reduce the imbalance between the different modes. It could be favorable to increase the usage of intermodal transport. Given that almost two thirds of Swedish companies consider intermodal transportation in the future, such transportation offers the government the possibility to leverage the imbalance that exists between different transport modes.

Some of the problems with uneven transportation and increased congestion in Sweden are partly solved by regulations. From the road transport sector, we can clearly see a trend towards increased competition within road transport. As mentioned before, trucks have the advantage of being enormously flexible and of being able to offer services to almost any location. Most of the working trucks today serve as a universal coordinator to all other modes and represent almost half of all transported freight within Sweden and the UK.

Because of the fierce competition in the road transportation market, the price of road transport service has decreased dramatically. It seems like the government will not easily influence companies to change purchasers' buying behavior. The high service quality and relatively lower price are important for services purchasers. However, the low road transport price is due to that several kind of external costs have not been included into the price (see example in section 5.2.4). Thus, the government could require the transport industry to consider the "external" costs, as mentioned in section 5.2.4. Therefore, trade-offs between price, service quality, environmental impact and other important aspects are crucial for the transportation provider. The "external" costs take on many different forms, such as congestion, road damage, accidents, noise and regional/local/global environmental effects.

The total cost of an environmentally friendly transport is usually higher than the cost of regular transport mode. In order to provide higher transport services quality to customer, the transport provider has to invest more time and resources to improve the way of handling transports and facilities. Obviously,

this will result in an increase in transport service cost. For example, rail transport is a "greener" transport mode when compared with road transport. However, the loading and unloading procedures waste time and add costs. In terms of technical solutions, the "greener" the transport, the longer the delivery time. At the same time, the transport buyer has to increase the safety stock level. In the near future, transportation buyer's total cost will increase; nevertheless, this will result in lower cost for society, since the "external" costs will decrease.

In the near future, it will become an absolute necessity to internalize these "external" costs. There exists a variety of different means of doing so, for example, road pricing, toll systems, CO_2 tax, NOx tax and other differentiated tax systems (for different fuel classes).

7.5 Objectives and challenges of the SNRA

From the exploratory research, we can see that the SNRA has many long-term and short-term goals such as reducing different types of emissions. Most goals have been achieved by the SNRA; however, the most important one, the target of reducing carbon dioxide emissions, has not yet been achieved, which is the major contributor of increased green house effect. A further challenge for the SNRA is the number of people exposed to noise. As seen in (Diagram 1: People exposed to traffic noise above 65 dBA) from the year 2001, noise started to increase. The main reason for these difficulties is the dramatic increase in use of cars and freight transport.

In the rapid economic growth and globalization of markets, emerging needs for transportation are unavoidable. Since economic growth is a fundamental part of achieving high welfare and increasing industry specialization, transportation will continue to increase. Therefore, reducing the total percentage of transport is not a wise choice for reducing the environmental impact; instead, the SNRA has to search for answers elsewhere. The best way of achieving significant reduction of the environmental impact is to achieve better utilization of available resources. This target can only be achieved by dramatically changing the behavior of organizations.

In order to achieve these goals, the SNRA must put much effort into working more closely with the transport industry, otherwise; the interim goal will not be achieved.

Further, we can see a parallel to the example in section 5.2.4, regarding prices within the transport industry. The decline in price for purchasing transports will increase the competition. According to Win-Win Solution, the best strategy is to face the competition, encourage innovations, and exercise efficient pricing. Due to the increased competition, competing with alternative options, such as bio fuel and intermodality solutions, might become too expensive to use and difficult to market as an attractive means of transport. One cannot blame the market for this development; the government has to take on an active role as a regulator and a facilitator. As seen in example "Fair pricing" 5.2.4, the government should actively be involved in decisions and development of transportation policies and regulations. In order to achieve Win-Win results between government and industry, we believe the communication between the government and companies should be improved. That is not only a requirement for the government, as companies also need a good communicator to present their difficulties and suggestions to the Swedish government.

Additionally, in order to implement environmental goals and policies within the SNRA and ensure co-workers' acceptance, the SNRA is working on improving its present environmental management system. This system enables clearer communication between environmental policy, planning, and implementation, operation, checking, correcting action and management review and integrates them with other related activities. This system ensures that mistakes are eliminated and corrective actions taken immediately. When finishing the implementation of the goals within the SNRA, the SNRA will become more efficient in communicating and spreading national environmental targets. In order to inform the market concerning environmental targets, it is imperative to start with a flexible organization that can communicate policies, and act consistently as one "intelligent" organization that can link the short-term with the long-term goals. Successfully establishing goals and polices, according to

theories, SNRA has to have a closer relationship with the government and private actors.

8 Conclusion & Recommendation

Our conclusions are based on the analysis of our empirical results and through comprehensive theory studies.

In the theory, there exists huge amount of information that advocates the great importance of using environmentally friendly logistical solutions; the emerging problem is to embrace the most suitable solution for companies, the SNRA, and the Swedish government. After the analysis of problem, we make some conclusions and give some recommendations to the SNRA.

Even though many companies are willing and highly interested in using methods such as intermodal transportation, it will be extremely difficult to increase the usage of these methods. The SNRA will not easily influence the Swedish transportation market. The road transportation market is still highly competitive in comparison to modes such as rail and sea freight. Not until leveraging the market competition can be achieved competitiveness between the different modes, and prices for transportation become fair. However, the following section will give recommendations that could be applied to the transportation market, regarding alternative methods and techniques.

8.1 Active communicator

First, communication is essential between companies and government when implementing environmental regulations. The inefficient communication can result in the unsuccessful implementation of environmental regulation on each level within companies. Another aspect that requires improved communication is the development of environmentally friendly technology. Since companies cannot fulfill the huge investment demand for technological research, the government must provide financial aid to them. In order to improve the efficiency and effectiveness of communication, we consider that the SNRA should act as an “active communicator” between the government and transportation industry.

The “active communicator” means that the SNRA should assist the government in implementing environmental regulations into the transportation industry and ensure those regulations are fully accepted and followed. We can see in the analyses, the unsuccessful implementation of environmental regulation is not only the problem of companies. The SNRA should be responsive to the government in considering whether it is possible for companies to put each environmental regulation into operation. It will be easier for both the companies and government to achieve Win-Win solution.

By acting as an “active communicator”, the SNRA should promote and support the development of environmentally friendly technologies and solutions by presenting them to the government. We have mentioned in our analysis, most of new logistics technologies and solutions derive from universities’ research programs and various logistics departments within the industry. The development of new technology demands huge investments, improved infrastructure, and raising expertise within each given area. In order to push technological research and development ahead, government, industry, and universities should conduct research projects together by combining resources from each part and exchanging professional experience. For example, the SNRA could organize different research fairs where companies, universities, and government can exchange information regarding new technologies and proactive solutions. As a result, the government can understand what kind of new environmentally friendly technological research universities or companies are conducting, as well as see if there is a shortage in the investment or expertise areas. The companies can detect what kind of research or new logistical solutions relating to the environment and transportation can generate revenue for the company. Simultaneously, universities can present their research project to the government and companies, and receive the necessarily investment from private and public sectors. The aim of research fair is to ensure different parties know in which way they can work together and promote the development of new technologies.

From the study in chapter 3 and the analyses of our survey, we also have some other practical suggestions for the SNRA. These suggestions might be helpful for the SNRA to achieve their different long-term and short-term goals.

8.2 New regulations on road transport

We strongly recommend that the SNRA assist the Swedish government in implementing new aggressively designed environmental regulations in the road transport sector. For example, the SNRA could force companies to "internalize" external costs by requiring the road transport industry to meet particular standards. An additional possible choice is to take the example of "fair pricing" into consideration, such as introducing new strict taxation. The main principle of "fair pricing" is that transport users should pay for the cost they incur, including the external cost. The government can also offer different forms of financial incentives for new environmentally friendly transport modes, such as rail. It might be possible to leverage the imbalance between different transportation modes. In general, the competitiveness of rail and other transport modes can be increased by implementing "fair pricing" due to more benefits from subsidies.

Obviously, problems exist in the implementation process of new regulations. For example, more taxation on the road transport sector or financial incentives to rail maybe result in unfair competition between different transport modes. We do believe that charging for marginal social costs would indeed need much work on how such charging should be applied in practice.

8.3 Encourage the using of Intermodal Transport

To increase the use of intermodal transport provides a feasible way for the SNRA to reduce environmental impacts from the road transport sector. Nevertheless, not all freight transport currently carried by road can simply be switched to rail for obvious reasons. The SNRA should encourage companies to consider switching some parts of road transport to rail transport. For example, the freight transport between northern and southern Sweden should mainly consider using rail way.

One reason why the intermodality has not been acknowledged in a satisfactory way is that intermodal transportation demands standard measures and sophisticated infrastructure. In order to promote the use of intermodal transport, it will be crucial for the SNRA to develop freight integrator and to standardize

loading units and pallets. In order to improve road transport infrastructure, the SNRA should establish a toll system on selected or high frequent highways, as well the size of the vehicle. The income from the toll system should go straight back to the construction of the infrastructure.

As mentioned before, internalization of external cost is a recommendation. This would in fact improve the competitiveness of intermodal transportation. However, it is not the sum of external cost, but the coverage of external costs by the balance of taxes, subsidies, and charges, which should motivate implementation of internalization actions. We can see from the research that many companies are willing and very interested in using intermodal transportation; nevertheless, the conclusion is that intermodal transportation still is too expensive to use, too time consuming and not yet reliable enough. All the transshipments that take place are today not fully reliable or flexible enough. A lot of work has to be done before intermodal transportation will become competitive enough to compete with road transport.

The task for the SNRA will be to offer some kind of tax releases within rail industry and sea freight. The government can offer tax releases in order to attract companies (In Ireland for example, they gave tax releases in certain areas, and by this, attracted large-scale companies such as IBM).

Lack of cost coverage could also be an incentive program for intermodal transportation in order to improve the quality. A good example could be to place rail terminals outside populated areas or non-urban areas, which will require heavily investments.

8.4 Training programs

As mentioned before, the investigated industry has a strong willingness to become more environmentally friendly. We do believe that the SNRA should put more emphasis on training programs. Nowadays, there exist some training programs in driving school, such as the EcoDriving. However, more systematic education for companies is needed in order to increase transport purchaser and provider’s environmental awareness. At the same time, the SNRA could create

an action package for companies, which are involved in either the transport provider or the transport purchaser. The action package should involve several aspects in order to radically change the company's behavior, as seen in Table 8.1: **Action Package**.

Transport Purchaser	**Transport Provider**
Should put demand on the transport provider: ➢ Environmentally friendly technology ➢ Training and Education ➢ Driving style Plan their Transport by: ➢ Order the transport well in advance ➢ Have greater flexibility in collection (time-window) ➢ Co-ordinate with other transports	Should consider following aspects: ➢ Use the most energy-efficient fuels as possible ➢ Lower driving speed ➢ Continues maintenance ➢ Introducing measures for reduce fuel consumption ➢ Consolidation of goods ➢ Co-operate with other providers ➢ Utilizing IT solutions, such as GPS and route planning systems

Table 8.1: Action Package

Finally, the SNRA must put more emphasis to companies regarding the importance and benefits of becoming a more environmentally friendly organization. Buying and utilizing "green logistics" can boost their image and lead to increased market share for their product and service.

8.5 Proposal for further thesis work

Due to the lack of deep knowledge on environment and transportation, especially the knowledge of some technological innovations, we did not discuss any particular technology in the research. Therefore, our study has become not profound since we only have been able to investigate the topic from the surface of the complicated problem. Some points that we believe could be analyzed further in order to come up with more precise results and conclusions follow:

- "Fair Pricing" is of course a choice for the Swedish government to create incentives for the use of other more environmentally friendly transport modes. However, the feasibility of implementing "Fair Pricing" in Sweden should be considered cautiously.
- The improvement of infrastructure is vital for increasing the usage of Intermodal Transport, especially in connection with sea transport and rail transport.
- Further research within the area of environmental technology innovations with the aim of reducing the environmental impacts from road transport sector.

Furthermore, a deeper investigation regarding the different implementation methods and the steps involved in the implementation would be of great interest, especially the ones concerning the implementation regarding various incentive programs.

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Appendixes

Appendix 1: The Questionnaire

Introduction Letter for Companies

We are two students from the School of Economics and Commercial Law in Gothenburg, Sweden. We both attend to the Master of Science program. On the behalf of the Swedish National Road Administration (SNRA) the division that deals with the overall sector responsibilities for the entire road transport system, similar to the British Department for Transport (DfT), we are now conducting an investigation regarding transportation logistics in connection with environment issues.

We would very much appreciate your help by answering a few questions. The result from the questionnaire is immensely important for the result of the research. Please mark your answer. All the answers will be presented anonymously.

<u>Questions regarding Environment policies</u>

1. Is your company a transport provider or a manufacturer?

   □ Transport Provider
   □ Manufacturer
   □ Other _____

2. Could you briefly describe your position in the company (area of responsibility)?

   _____

3. How significant do you think it is to take practical actions, concerning the environment policies regarding your company?

□ Very important
□ Important
□ Of small importance
□ Insignificant

4. Do you know if your employees have accepted the environment policies it might concerns?

□ Yes, fully accepted
□ Yes, partially
□ No
□ Uncertain

5. Have the environment policies generated any goals within your company. An example could be, "using new technology and logistical solutions in order to reduce CO^2 emissions and road transport".

□ Yes, please give an example _____
□ No
□ Uncertain

6. Do you think your company has achieved its environment goals of 2003?

□ Yes
□ No
□ Uncertain

7. If your company's environment goals are achieved in 2003, does your company still plan to improve them selves next year? For instance, "continue to reduce CO_2 emission to a lower level" etc.

□ Yes
□ No
□ Uncertain

8. Does your company have an "action plan" in connection with the environment policies?

□ Yes, please shortly describe the activities involved _____
□ No
□ Uncertain

Questions regarding Logistics and Transportation

9. Regarding the environmental issues, does your company conduct research or development on logistical solutions? (Route planning, intermodality solutions or GPS systems, etc.)?

□ Yes, if so, what kind of research? _____
□ No
□ Uncertain

10. Have you seen any new trends emerging in your line of business, such as new technological innovations within freight transports today?

□ Yes, namely_____
□ No
□ Uncertain

11. If so, is there any technological or other innovation your company use today or planning to use?

□ Yes,
namely_____
□ No

12. What benefits do you think the company can achieve by using these innovations?
Please
describe_____

13. When choosing a transportation provider, are there special features your company typically requires? (multiple answers possible)

□ Price
□ ISO Standards
□ Service quality
□ Intermodal Transport availability
□ Environmentally friendly means of transport
□ Other,
namely_____

14. If your company is buying transport services, what kind of transport is your company mainly using?

□ Road
□ Sea
□ Rail
□ Air
□ Intermodal Transport

15. Are intermodal transports a solution your company would consider using in the future?

□ Yes
□ No

16. Does your company experience any negative or positive effects from the work that the SNRA is conducting today?

□ Positive
□ Negative
Please explain_____

17. Is there anything that the SNRA could do in order to improve your business?

Namely

_____

Thank you for taking the time to fill in this questionnaire. The answers will benefit us a great deal within our research.

Yours sincerely

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Appendix 2: EcoDriving

As a concept, Economical driving is derived from Finland. In 1998, this concept was adapted and changed to EcoDriving by National Association of Swedish Driving School (STR), with the support of the SNRA and the Swedish National Energy Administration.

Because EcoDriving style can reduce the emission of carbon dioxide, it attracted more and more attention in recent years.

As known, the emission of carbon dioxide directly related to the consumption of fuel. The Experiments conducted in Borlänge and Tylösand in 1998 and 1999 show that the fuel consumption decreased by an average of 11% in Borlänge and 12.5% in Tylösand. As a result, the emission of carbon dioxide also reduced by 11% and 12.5%. The merits of EcoDriving are not only the reduction of fuel consumption and the emission of carbon dioxide but also traveling times. The experiments also show that the time it took to cover the route reduced by 5.3% in Borlänge and 1.8% in Tylösand. This result must be regarded as typical of the results produced by training in EcoDriving.[73] There is no congestion in these two experiment places. This means that the EcoDriving style really can help driver to reduce the fuel consumption and emission of carbon dioxide in suburb areas and on highways. In urban areas, the frequently congestion results in more stoppages of vehicle. This traffic condition will have a greater effect on fuel consumption and thereby saving fuel, while it is very difficult to drive economically unless economic style of driving is applied.

Based on EcoDriving, the principle of economic driving style should be:[74]

1) When starting the vehicle, driver should attempt to change up as quickly as possible to second gear and then to higher gears at one-third to half-throttle.

[73] Impact of EcoDriving on emissions and fuel consumption, 1999
[74] Ibid

2) Accelerate in each gear until the engine speed reaches the point at which engine torque is at its highest (normally around 3,000 rpm), thereby avoiding driving at excessively high engine speeds.

3) If the vehicle does not have a tachometer, accelerate in first gear to a speed of 10-15 km/h, in second to 40 km/h, in third to 60 km/h and then in fourth or fifth gear to higher speeds.

4) Made a plan before the vehicle reaches intersections and traffic lights or if the driver sees that a vehicle in front of him is going to turn. Put the vehicle in neutral and freewheel or brake via the engine (injection engines) and approach in such a way as to give the traffic lights time to change to green or to enable the driver to continue driving without stopping unnecessarily.

5) Drive to match the rhythm of the remainder of the traffic. On roads with busy traffic,
Overtaking does not save that much time, but it does increase fuel consumption.

6) Learn to drive, keeping the throttle at a uniform level (a suitable engine speed is around 2,000 rpm) and, depending on the topography of the road, use fourth or fifth gear whenever possible.

7) If the vehicle has a powerful engine and high torque, it is better to accelerate a little more rather than changing down to a lower gear.

Additionally, the reduction of fuel consumption of economic driving style can be affected by the different choice of vehicle, cold starting, air pressure and route planning. Therefore, it is very difficult to give a precise figure of what percentage of fuel will be saved by EcoDriving.