JYVÄSKYLÄN AMMATTIKORKEAKOULU

A Base Study for Strategy work out in Necl

North-Eastern Cargo Link project

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Content

1 Objectives of the Necl-project

1.1 Objectives of the Necl-project

According to the final report of the North-East Cargo Link (Necl) 060118, the objective of the Necl is to develop a transport corridor for the Mid Nordic Region which also has links to Russia and the western world. The Necl-project is divided into four sections: 1) to create an overall strategy, 2) to identify weaknesses for the transport corridor, 3) to create trade network, and 4) to implement the strategy. The project has started in 1996 and started to proceed under full sail in 2002 when the project was funded by European Union's Interreg programme.[1]

1.2 Objectives of the supporting study

In our study, we will try to supplement the goods flow's part and to introduce more infrastructure matters. Moreover, we will try to present today's situation in intermodal transportation system in Finland and also future insights of it. In Sweden, Ph.D Johan Woxenius has studied intermodal transportation system called Light-Combi. Ph.D Woxenius has also presented results of this study in an article. These results are important to know when constructing an intermodal transportation system. Also in Finland there has been a vast study about the intermodal transportation system made by transportation companies Vähälä Oy, Transpoint Oy and railway company VR Cargo Oy. We will use their experience and results in our report. Moreover, we'll try to describe opportunities for transportation that can be implemented in east-west direction. In addition estimations for intermodal terminal costs and its financing are made.

2 Studies

2.1 Study made by this far

We have received the final report of the North-East Cargo Link dated 18.01.2006. The report states, describes and illustrates goods flows between Sweden and Finland and between Norway and Finland very well. The study shows that about 280 000 tons of material was transported between Sweden and Finland and about 24 000 tons of material between Norway and Finland in the corridor. The quantities are modest as far as the trade volumes are concerned. The trade volume between Sweden and Finland is huge. The trade totals about 10 000 millions euros at yearly basis.

[1] NECL, North-East Cargo Link – a sample study on freight flows and values in the Mid Nordic Region, p. 4.

The study concentrates on goods flows and illustrates some weaknesses of the infrastructure within the corridor. The infrastructure issue is important to show and note.

2.2 Some supporting studies

As the final report states, the researchers have failed to gather information from Finland's situation regarding to the goods flows. That is why some supporting studies are brought here. These studies present trade volumes between Sweden and Finland and between Norway and Finland, cargo volumes and some necessary information concerning the infrastructure.

Trade values

Trade between Finland and Sweden and between Finland and Norway is significant. Finland's export to Sweden totalled 5 412 million euros and to Norway 1 483 million euros in 2004. Correspondingly the import totalled 4 450 million euros from Sweden and 1 003 million euros from Norway.

According to production type Finland's import has been divided as follows:

Products of agriculture and forestry	1 276 millions €	3,4 %
Products from mining and quarrying	4 850 millions €	12 %
Manufactured goods	33 145 millions €	81 % from the total import

Correspondingly Finland's export by production has been divided into following types:

Manufactured goods	47 763	97,6 %
Products of agriculture and forestry	398	0,8 %

Further, Finland's export and import is divided by product category as follows:

Product category	Export [%]	Import [%]
Products from metal industry	56	53
Chemical products	13	21
Textiles	1	4
Food	1,5	6
Wood, paper and paper products	23	5

Source: Statistics Finland, Statistical Yearbook of Finland 2005

Export and import according to the purpose of use

	Export [%]	Import [%]
Raw material and production articles	50 %	38 %
Investment products	34 %	21 %

Household appliances	5 %	12 %
Other consumption products	6 %	16 %

The following tables present the trade volumes between Finland and Sweden. Table 1 illustrates the import volume between Finland and Sweden according to product category and table 2 illustrates the export volumes.

Table 1 The import volume between Finland and Sweden according to product category

Product category	[million €]
Textiles and wearing apparel	130
Food, beverages, and tobacco	187
Chemicals, chemical products and man-made fibres (DG)	242
Nuclear reactors, boilers and mechanical appliances	652
Electrical machinery and equipment; sound recorders, reproduces	343
Furniture, upholstered furnishings, lamps	146
Basic metals	392
Mineral fuels, oil, etc.	137

Table 2 The export volume between Finland and Sweden according to product category

Product category	[million €]
Mineral fuels, oil, etc.	838
Nuclear reactors, boilers and mechanical appliances	493
Basic metals	770
Electrical machinery and equipment; sound recorders, reproduces	514
Transport equipment (DM)	338
Wood and wood products (DD)	122
Paper, pulp and paperboard	240
Iron and steel products	222
Textiles and wearing apparel	99

Source: Statistics Finland, Statistical Yearbook of Finland 2005

The trade of Russia

The trade between Finland and Russia has increased strongly in the 21st century. In 2003 the export value to Russia totalled over 3 500 million euros, and compared to the previous year the growth was 11,3 %. In 2004 the export value totalled over 4 362 million euros. In 2004 the import value totalled 5 320 million euros. The import included mostly energy products and raw materials of forest and metal industry. The following table illustrates the shares of export and import by product category.

Export		Import	
Food	5,2 %	Wood	10,9 %
Chemicals	14,9 %	Ore	5,8 %
Paper and board	7,6 %	Metals	7,4 %
Metals and metal products	5,8 %	Coal	4,8 %
Machinery, Transport equipment		Crude oil	41,8 %
and electrical equipment	47,9 %	Gas	12,2 %
Other	15,7 %	Electric	6,2 %
		Chemicals	7,7 %

Material flows in Finland

The majority of material is transported by roads in Finland. To illustrate the magnitude of road traffic some figures of goods flows between a couple of cities are presented below:

Between:	Million tons
Heinola – Jyväskylä	5
Lahti – Heinola	7
Helsinki – Lahti	7
Tampere – Seinäjoki	3
Hämeenlinna – Tampere	6
Helsinki – Turku	3
Hämeenlinna – Pori	3
Mikkeli – Varkaus	3
Kuopio – Jyväskylä	4
Jyväskylä – Viitasaari	4

The following figure 1 illustrates the goods volumes transported by road in districts.

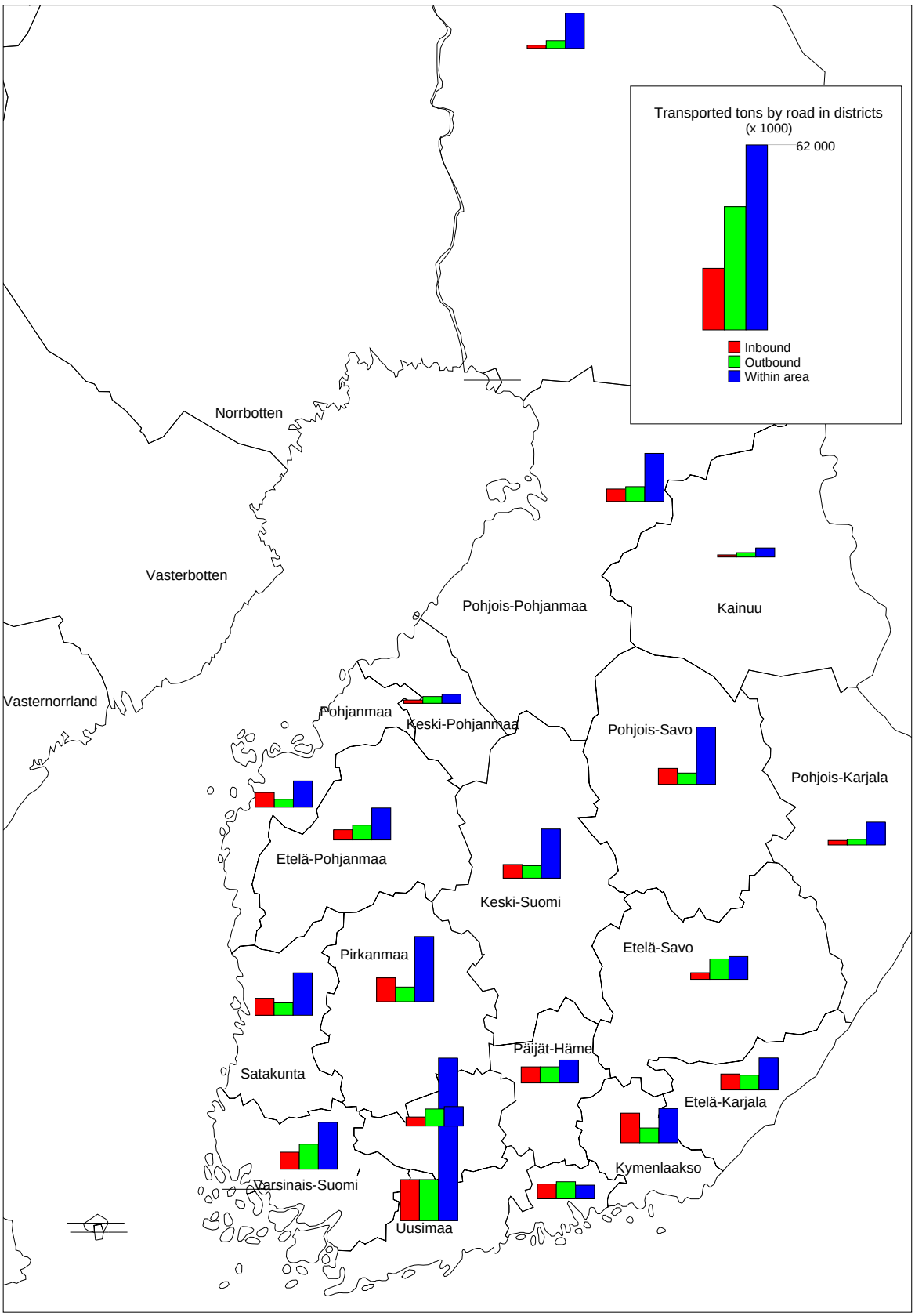

Figure 1 Material flows by province transported by trucks. Source: Statistics Finland

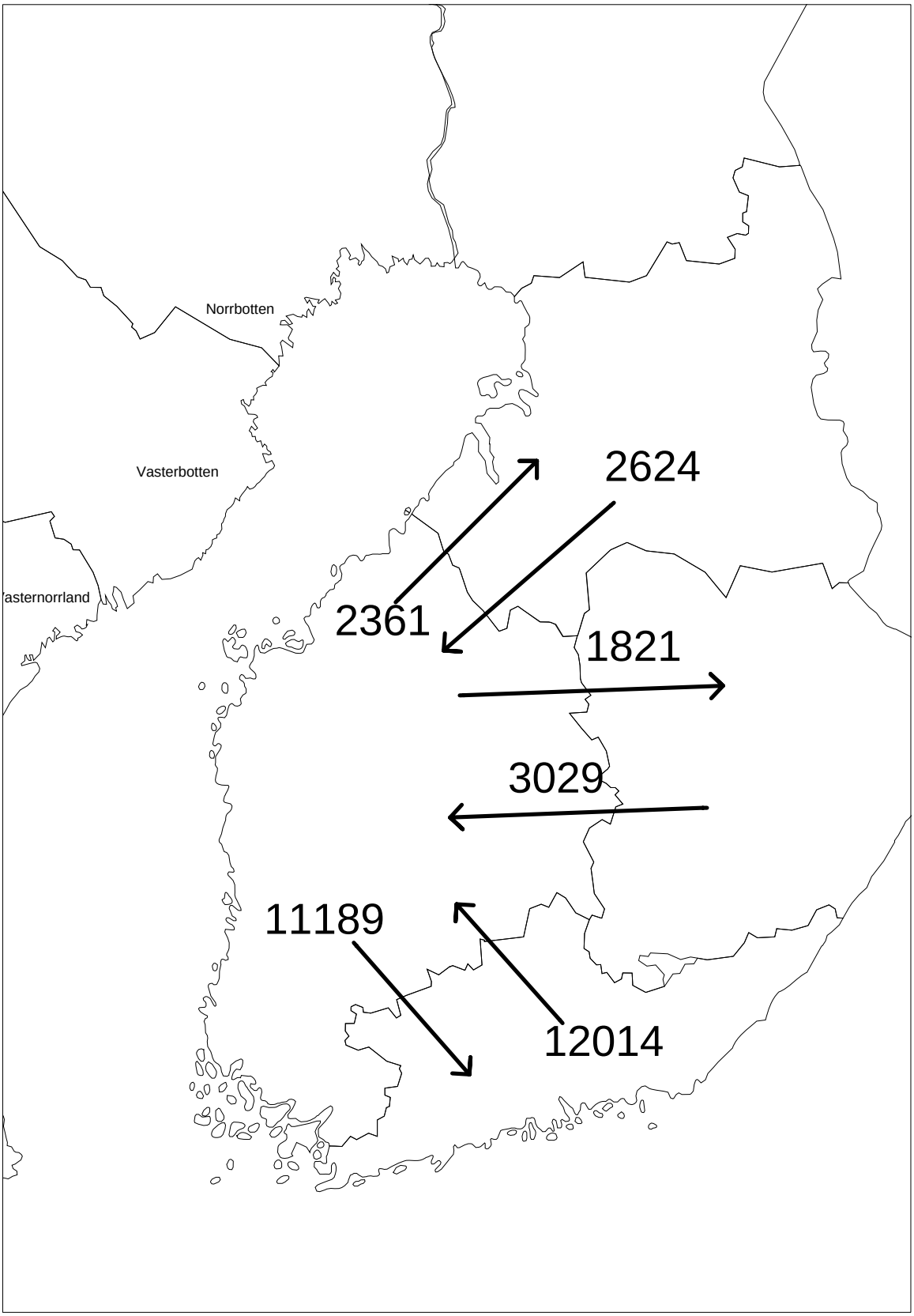

Figure 2 Material flows between administrative districts [tons, x 1000] Source: Statistics Finland

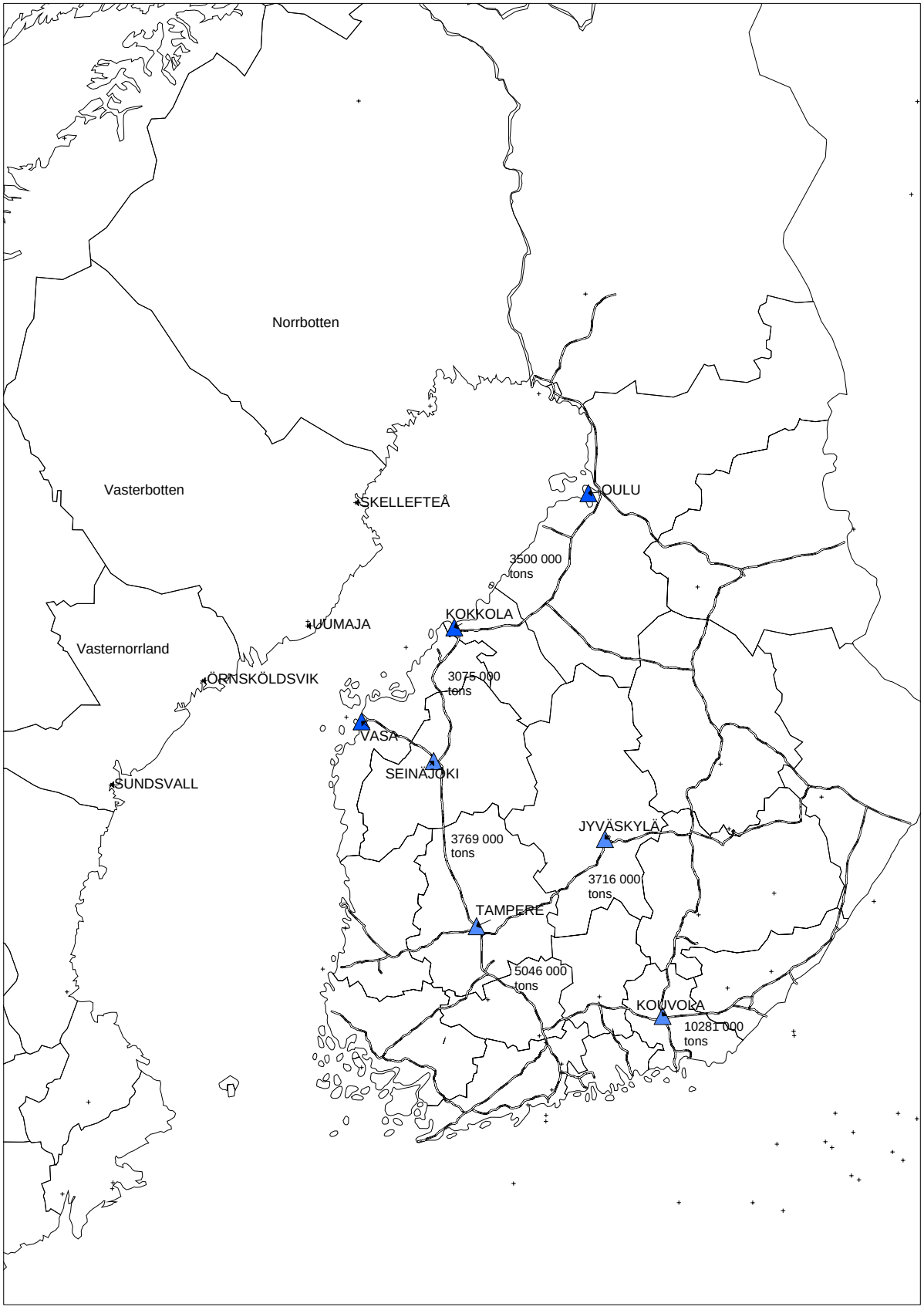

Figure 3 Category 1 railways and transported tons between some terminals

2.3 Situation in South Ostrobothnia

In the county of South Ostrobothnia, there are about 200 000 inhabitants in seven different regions. In the northern neighbour county there are 57 000 inhabitants. The branches are divided into agriculture and forestry 14 %, industry 23 %, construction 8 %, private services 27 % and public services 32 %.

Branch	Härmän-maa [%]	Järvi-seutu [%]	Kuusio municipals [%]	Southern neighbours [%]	Northern neighbours [%]	Suu-pohja [%]	South Ostrobothnia [%]
Electronics	0,6	0,5	0,4	0,6	1,4	1,9	1,0
Food industry	29,6	34,7	27,8	30,6	23,0	32,4	28,2
Energy	1,3	1,0	1,7	3,3	1,1	1,0	1,5
Chemical	1,4	0,3	0,1	0,1	0,1	0,2	0,3
Transportation	8,3	6,8	7,5	10,5	12,1	6,9	9,3
Metal	9,0	6,1	6,1	4,9	2,5	5,5	5,1
Forestry	2,3	2,4	4,8	6,7	2,9	11,1	4,7
Construction	7,9	9,9	12,9	9,0	10,2	7,8	9,7
Welfare services	26,7	26,4	27,6	22,0	32,8	24,3	27,9
Textile	5,3	5,0	1,6	4,9	2,5	1,5	3,2
Support	7,7	6,9	9,5	7,5	11,4	7,4	9,1

The most important companies in the food industry are Atria, Primalco, Raisio and Suomen Rehu. About 40 % of the working people in South Ostrobothnia work in the food industry chain.

The wood product industry is divided into furniture and mechanical wood processing. Metal and electronics industry has grown.

According to a logistics research conducted in 2003, about 5 million tons of goods have been transported by rail through South Ostrobothnia. The amount of outbound material was 350 000 tons and the amount of inbound material was 400 000 tons. The goods transported by rail from the area are mainly raw wood, Primalco ethanol, Kaskinen pulp and Valio milk powder. The goods transported to the area are mainly raw wood and steel raw materials.

The figure 1 illustrates the goods transported by road. Within the area of South Ostrobothnia the transported goods are mainly single consignments. In 2004, the amount of transported goods totalled about 12,4 million tons, when it in 2001 totalled 17,4 million tons (Statistics Finland 2005, Seinäjoen liikennejärjestelmäsuunnitelma 2003). In 2004 the amount of outbound

transported goods totalled 5,6 million tons and the amount of inbound transported goods 3,9 million tons. Thus the amount of transported goods has decreased.

The direction of the transported goods	Year 2001 [1000 tons]	Year 2004 [1000 tons]	
Within the area	17 500	12 400	
Outbound	6 125	5 628	
Inbound	4 315	3 884	

The inbound goods come mainly from South and Southwest Finland. The outbound direction is also mainly south and southwest. Some amounts of goods come also from Ostrobothnia, from the Vaasa area. The logistics research evaluates that 27 % of the amount of inbound and outbound goods are transported between South Finland and South Ostrobothnia and 18 % between Southwest Finland and South Ostrobothnia (Seinäjoen liikennejärjestelmäsuunnitelma 2003). Thus the goods are mainly transported on main roads 19 and 3.

The inbound goods are mainly raw materials, food supplies and other consumer goods. The outbound goods are mainly production goods, daily consumer goods and other consumer goods. The industry structure of South Ostrobothnia has favoured the ports of Helsinki and Turku (Mäntynen, 2004). There is no so called bypass road in Seinäjoki. The question is that if it is worthwhile to construct it if transports are transferred on railways?

The goods transported via port of Vaasa in 2002 and 2003:

Year	Import [tons]	Export [tons]
2002	1 320 569	243 594
2003	1 373 437	161 887

3 Transportation and logistics

3.1 Trends of logistics

Logistics know-how has become a significant competition factor for companies. Customer orientation, importance of individualism, networking of companies and shortening of products' life cycle are the new trends of logistics.

Characteristics for the improvement of logistics are automation of terminal and port operations, utilization of information technology in management and follow-up of supply chain, growth of frequency in sea transportation, better consolidation of transports' different parts in supply chain, decrease in amount of warehouses and in warehousing times, and specialization of

transportation companies. The decrease in amount of warehouses means centralization. World-wide operations constitute large distribution centres, one in every continental. A nation is serviced from one national area warehouse. This kind of logistics structure means longer distribution transports. As an example the following figure 4 present the centralization for a few industry branches. For instance in automotive industry the share of distribution centres that serve more than one country has increased 20 % within five years.

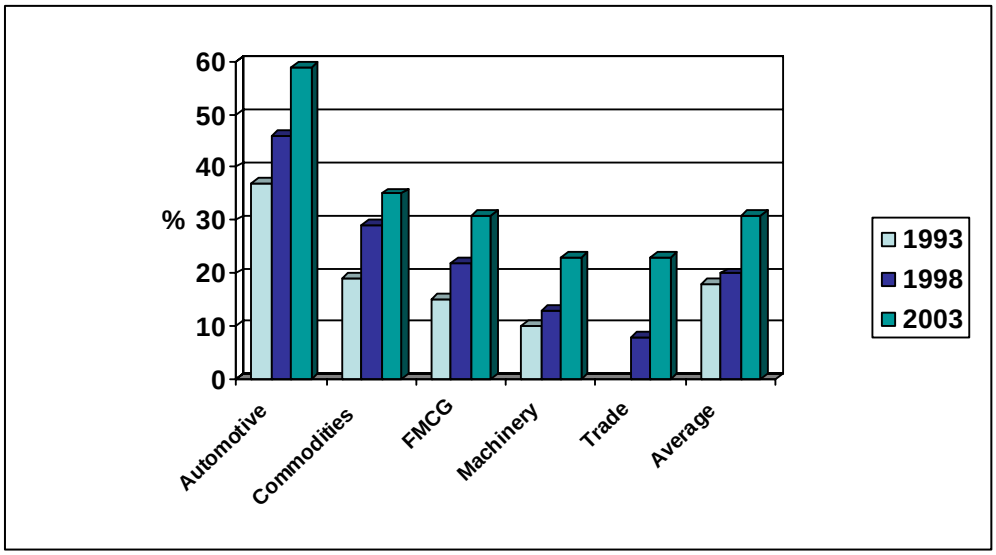

Figure 4. Distribution centres that serve more than one country

At the same time the inventory measure, days of supply has decreased significantly in leading enterprises. This requires punctual deliveries.

The cost efficiency is an essential part of the transportation of forest, construction, metal and chemical industry products and raw wood material. The quickness and punctuality demands of goods transports require the traffic routes:

- to ensure the fluency of traffic by investments and extensions, concerning especially main road connections, ports and airport connections
- to improve the functions by the new technology
- to increase capacity of utilization rates in air freight points and ports
-

The improvement of the cost efficiency in goods transportation requires

- ensuring the condition of road and rail network by investments
- ensuring the functionality of sea ways
- improving the capacity of ports concerning the utilization rate

The share of transportation of valuable goods is increasing. Valuable goods have a high degree of processing, for example machines, medicines and home electronics. Quickness and punctuality are also important for valuable goods transportation.

3.2 Transportation infrastructure

Road transportation
As funds for building rails and roads will decrease all the time in future a new approach has been taken into use regarding the infrastructure construction. In Finland roads, rails and terminals have been classified according to their significance. The release of the Finnish Ministry of Transport and Communications, Nationally important transport networks and terminals, tries to find solutions for that. The release divides traffic networks to different classes, so that that the limited investment resources could be divided as efficiently as possible. Nationally important transport networks and terminals are also divided to core networks that are the most important parts of transport networks.

There are altogether 9 640 kilometres of nationally important roads and streets. That includes main roads, TEN-roads and E-roads, roads that lead to official border crossing points and to nationally important terminals. It is proposed that 2 270 kilometres of the whole transport network should belong to the core network.

According to a new definition, there are 20 nationally important ports, of which 19 inshore ports and all the ports at Saimaa-lake (10) as a whole. There is altogether about 2 230 kilometres nationally important waterways, of which seaways about 1 560 kilometres and 670 kilometres of Saimaa deep-water channels.

The nationally important freight terminals are either seaport terminals or road traffic terminals. As nationally important seaport terminals is being proposed the seaport terminals of Helsinki, Kotka, Hamina, Hanko, Turku, Naantali, Maarianhamina, Rauma, Pori, Vaasa, Kokkola, Oulu and Kemi. As nationally important road traffic terminals is being proposed the road traffic terminals of Lahti, Kouvola, Lappeenranta, Tampere, Mikkeli, Seinäjoki, Jyväskylä, Kuopio, Joensuu, Kajaani and Rovaniemi.

Railway transportation
In developing the railways a kind of ranking system has been taken into use. The ranking system uses the classification of core network and other railway tracks. The definition of the goods transportation's core network is based on the amount of goods transport on different railway tracks, the significance of the link to industry and needs of heavy transportation. The network connects the most important goods flows of industry and business life and leads them to ports and border crossing points. The core network of the goods transportation ensures punctual and efficient export transports on the most trafficked railway tracks. The length of the core network is 2 030 kilometres. The figure 3 presents the core network.

4 Transportation corridors

A corridor means a transportation route where the majority of goods are transported either by sea, road or rail or using a combined system. The important corridors for Finland are

- Nordic Triangle
- The Baltic Sea Route
- Crete Corridor 1
- Crete Corridor 9A
- The Arc of Botnia and
- Trans Siperian Railway (TSR)

The Arc of Botnia[2]
The Arc of Botnia means the region from Luleå to Oulu. Vision of the Arc of Botnia has been built at the end of 90-decade. The railroad has been built on the coast between Umeå and Haaparanta. The rail is built as a high-class railway. In the border between Sweden and Finland there is a converter that changes the width of axles for rail wagons. This enables the transportation between Sweden and Finland by rail. In the near future the technique will be further developed so that it is possible to change the width of axles for rail wagons when the train is running slowly.

An intermodal transportation terminal has been built to Gammelstad in Luleå. Logistics Centre in Oulu has also an intermodal terminal. Umeå has also an intermodal terminal.

Nordic triangle is a significant connection for Finland. Nordic Triangle locates from Gulf of Finland to northern Germany through Baltic Sea or through Swedish road link. The Nordic Triangle is the main channel of export and import. The Nordic Triangle connects the Nordic capital cities Helsinki, Stockholm, Oslo and Copenhagen.

Also the road link through Baltic countries to Poland and Germany has increased its significance. In White Karelia in Russia, there is a lot of raw material transports in north-south direction. Also some raw materials are transported via Vartius to Rautaruukki in Raahe.

For the competition against deep-sea transportation a new connection of railway has been designed. The new railway connection is called Trans-Siberian Railway that connects the Asia rim states with Europe. Trans-Siberian Railway uses block train concept and it is currently operating between Vostochny-Nakhodka and Kouvola (Finland). Block trains normally consist of about 50 wagons and 40 feet containers. One of the western ends of TSR is located in Kouvola that connects TSR with EU Corridor 9. The route can then continue westbound or southbound. The Trans-Siberian Railway is one opportunity to establish traffic between Scandinavia and Russia. This connection must be linked with the Arc of Botnia. The other

[2] Liikennejärjestelmän nykytila ja alustava visio, 2000.

western end of TSR is St Petersburg, where containers can be shipped forward with ships.[3] The price for a container for example from Kotka to Jokohama is 3 310 USD.[4]

5 Transportation systems in Finland

5.1 Road transportation

The freight transportation is an important part of companies' supply chain management. The production chain of an industrial company consists of many transport parts concerning both procurement and distribution. The transportation systems are structurally very complicated and they require many human, financial and material resources. The cost of transportation makes the most of the logistics costs. The share of transportation is 1/3 to 2/3.

The transportation parts can be divided into two types; long haulage and distribution and or pick-up transports. In long haulage the goods are transported relatively long distances either between terminals or between different plants. The plants can be factories, warehouses and distribution centres. The long haulage can be executed by road, rail, sea and air or by combining them. The distribution transport can also be named as short distance freight transportation where the goods are transported mainly by truck as pick-up or distribution transport. The pick-up and distribution destinations usually consist of certain amount of customers in a specific area.

The transports can also be divided based on implementer or forwarder. An industrial company or a distribution company can choose three options how to transport their materials. First of all companies can take care of the material transports by own or rented transport equipment. Secondly companies can outsource the material transports. In this case, there is made a contract of transporting the materials. Generally that is called contract transit. In contract transit there is made a long-term transport contract between the cargo owner and the transportation company. The transport contract apply to

- transportation of a specific goods lot
- continuous transportation of a specific material with no specified amount
- continuous transportation services for a specific cargo owner

Another type, very similar to contract transit is order transit where the transport is handled for a specific task based on an order. In this case the transport equipment in use is under an authority of the orderer and is not allowed to take any other cargo onboard. In contract and order transit transportation routes are formulated based on transport orders.

[3] The Asian Link
[4] Logistiikkalehti 7/2004

The third type is to use a line traffic company. It is called goods line traffic that is regular traffic on specific routes. In this mode, a line traffic company is filling the transportation needs of several consigners.

5.2 Rail transportation

VR Cargo is responsible for railway transportation in Finland. The transportation system of VR Cargo consists of:
2 central organising railway yards
Transportation volume 42 million tons
About 11 000 wagons
About 300 diesel locomotives and 150 electric locomotives

The trains are divided by their usage to base trains, straight trains, customer trains, order trains, raw wood trains, empty wagon trains, TK-trains and local area trains. In addition there are also intermodal trains. The supply of the system is based on the needs of the core customers. [5]

5.3 Transit transportation

Transit transportation totalled 5,6 million tons in 2004. The majority of transit goods imported to Finnish ports in 2004 came by sea from the west and continue by road or sea to Russia. The imported transit goods were mainly piece goods and are transported in containers. The share of piece goods from all imported transit goods was 70 % and totalled 1,9 million tons. Another significant product category was metals and metal products. The share of the imported transit goods was 42 % from all transit transportation.[6]

The majority of transit goods exported from Finnish ports come by sea or rail from Russia and are exported by sea to the west. In 2005 the transit transportation has stayed at the same level as in previous year. However, the share of imported transit goods has increased. Especially containers have been transported to Russia from Finnish ports. These containers include home appliances and other electrical appliances. A car is a particular item transported from west to east via Finnish ports. The year 2005 was remarkable in that respect that the imported containers exceeded the exported containers. The estimated trend is that imported containers will continue to increase.

[5] VR Cargo
[6] Statistics Finland, Statistical Yearbook of Finland 2005

The main ports used to transit transportation are Helsinki, Kotka and Hamina. Also the port of Kokkola has been used intensively especially for pellets transportation. Pellets are transported from Kostamus, Russia to Kokkola. From Kokkola these pellets are then transported to Baltic countries or to Russian's own ports.[7]

Ports, especially Kotka have collaborated with VR Cargo with respect the transit transportation. For example VR Cargo has designed a block container train from Kotka to Moscow via Kouvola. This might be a good innovative model that could keep the Finnish transit transportation as competitive and might also be attractive in the eyes of Russian importers.

6 Interviews

6.1 Questionnaire

The information was gathered by company interviews. The questionnaire was formulated before hand for both industrial companies and transportation companies. The questionnaire was sent to the companies before the interviews. The questionnaire was filled during the interviews with the representatives of the selected companies. The selection of the companies was based on two factors: turnover and the share of export of the whole production. The turnover was to exceed seven million euros and the share of export was to be over twenty percent. With the help of these restrictions the companies that would meet the purposes of the NECL-project were chosen. All the selected companies are situated in the Central Finland area or a bit northern. The interviewed companies divide by branches to 40 % mechanical industry, 40 % metal industry and 20 % woodworking industry.

The purpose of the questionnaire was to clarify the size of goods flow, as for example lot sizes, transportation frequencies and delivery terms. Noteworthy was also to map matters concerning packaging and intermediate warehousing. The interviews included also the transportation modes and transportation companies used. The development prospects from a logistics point of view were also discussed.

6.2 Interview results

The results of the interviews showed the direction of the goods flows in Central Finland area. The largest flows were directed to United States, where almost third of the export directs. The goods flows to United States go mainly through ports in southern Finland where the transportation chain continues by sea.

[7] Transpress, VR Cargo's asiakaslehti nro

The second largest goods flow from Central Finland directs to Sweden (18,3 %). The goods flows go through ports in southwest Finland to the Stockholm area. The most important port of departure is Turku. The most important transportation mode to Sweden and Norway is road transportation.

According to the interviews, the share of export in Central Finland is quite similar to the whole export in Finland. This can be seen also in the results of the interviews as a larger amount of goods flow to Russia (11,5 %) and Germany (9,8 %). To Russia the goods flow goes through Vaalimaa mainly by road. Regarding to export, Sweden can be said to be in more important role than Norway (3,1 %). (Figure 5. The export by countries of the interviewed companies.)

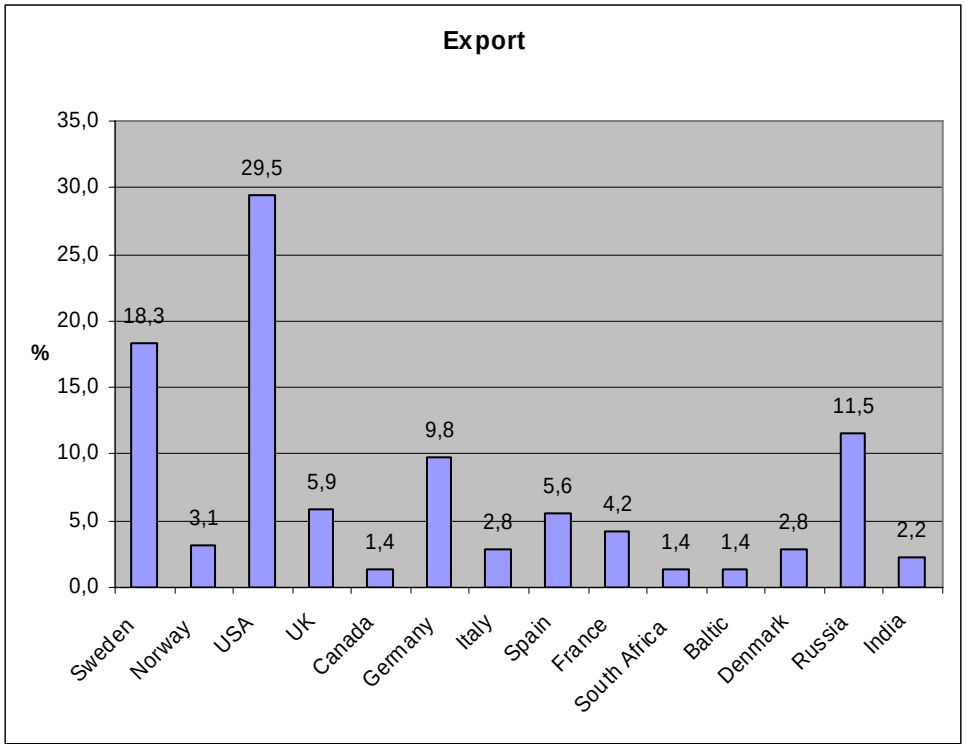

Figure 5 The export by countries of the interviewed companies

In Central Finland area there are fewer companies that have import trade than companies that have export trade. The biggest import country is Germany, where from almost half of the goods flow comes. Mainly raw materials such as base metal and mechanised components like bearings are imported from Germany.

The next biggest import countries are Great Britain (22,2 %) and Italy (18,6 %). The share of Sweden (6,0 %) and Norway (6,0 %) is very small compared to other goods flows but still considerable concerning the NECL-corridor. (Figure 6. The import by countries of the interviewed companies.)

Based on the interviews it can be seen that there is no import from Russia or it is minor. This has to be taken into consideration concerning the NECL-corridor, because in this case there is no so-called return traffic for big units, for example. This way the return traffic would have to

be driven with empty units. The only considerable export products from Russia are forests and fossil fuels.

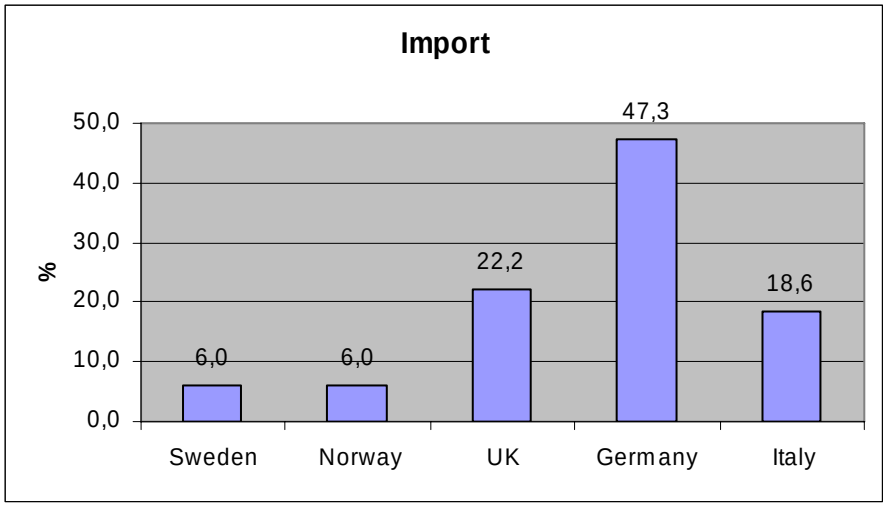

Figure 6 The import by countries of the interviewed companies

The NECL-corridor and the export and import flows of the companies in Central Finland area do not meet very well. It is essential for a well-working transportation corridor that the export and import are in balance. Without this there is too much weight on one-way transportations, what will harm payloads. According to the interviewed companies the amount of export to Sweden and Russia is much more bigger than the amount of import from Sweden and Russia. The export and import of Norway are quite in balance, what would indicate that Norway is suitable considering the NECL-corridor. But it is still questionable considering the volumes of export and import in Central Norway (0,9 %).

The amount of export to Sweden from Central Finland is big, but the destinations are concentrated in South Sweden. Goods flow to Central Sweden (11,3 %) is significant. The route to Central Sweden goes usually through ports in southwest Finland to the Stockholm area where from the goods are transported to Central Sweden. From Central Sweden the goods flow to Central Finland is minor. Some of the interviewed companies have let the transportation companies decide the route to Sweden. Then there is sometimes the option to transport via Haaparanta by road. Haaparanta route is usually considered only when transporting goods to North Sweden. (Figure 7. Goods flows concerning the NECL project.)

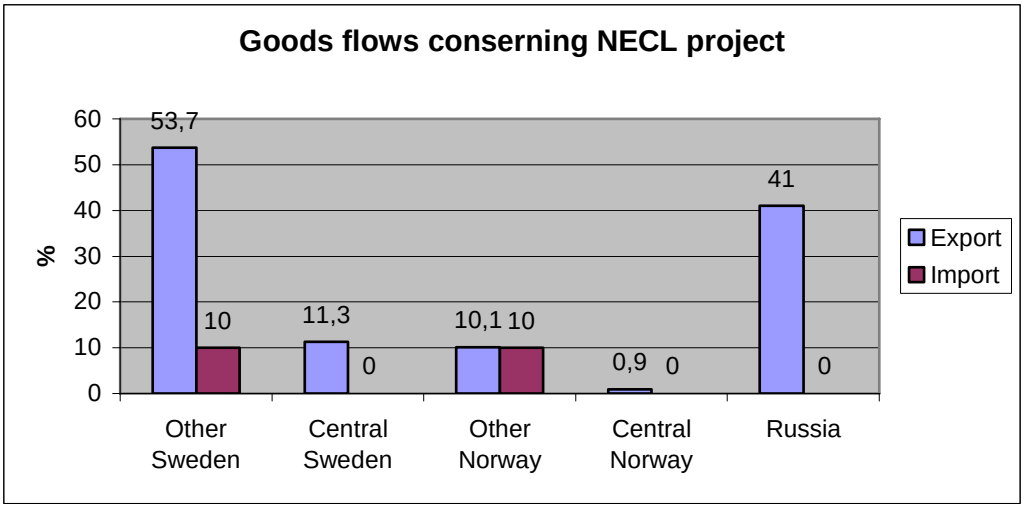

Figure 7 Good flows of interviewed companies

According to the results of the interviews, 60 % of the companies handle the packaging themselves. 40 % of the companies use intermediate warehousing during the transportation chain if necessary. The intermediate warehousing concerns the customs and terminal times. The rest 60 % of the companies do not use intermediate warehousing.

About 60 % of the companies mentioned the transported goods to be steel, iron or other metal products. 20 % of the goods are electronic components, rims or power transmission components. The rest 20 % are mainly plywood and paper. The transportation of dangerous goods is minor, but small amounts of paint, solvent, fuel and gases for steel hardening are still transported.

The transportation companies caused some dispersion among the interviewed companies. The transportation company DFDS was the only one to stand out of the rest. DFDS was used by 40 % of the interviewed companies at least in part of their transports. Other transportation companies were Schenker, DHL and Backman-Trummer. The interviewed companies are using two transportation companies in average. Also the delivery terms differed among the companies. Concerning export and import the main delivery term was FCA (Free Carrier), which was used by 60 % of the companies. Concerning only export, the main delivery terms used were EXW (Ex Works), DDU (Delivered Duty Unpaid) and DDP (Delivered Duty Paid), which were used by 40 % of the companies. In average, the interviewed companies are using three different delivery terms.

100 % of the interviewed companies are using road transportation and 80 % are using also rail transportation. 40 % of the interviewed companies are using road transportation especially to Sweden and Norway.

60 % of the interviewed companies deliver goods weekly or less frequently. The rest 40 % deliver daily or even more frequently. The average delivery frequency concerning all the interviewed companies is 11,6 deliveries per month. 40 % of the companies have a typical lot size of 20 to 30 tons in road transportation, 20 % have a lot size of 18 tons, other 20 % have a lot size of less than one ton and the rest 20 % couldn't specify any lot size for road transportation. In rail transportation the lot size is 25 tons for 20 % of the companies and 90 to 120 tons for other 20 % of the companies. The rest could not specify any lot size for rail transportation or they do not use rail transportation.

A restriction for transportations was the size of the transportation vehicles, so in practise width or length of the cargo space. 40 % of the interviewed companies say that the size of cargo space restricts the transports in some scale. 20 % of the companies say the customer is the determinate factor for transportations. Future prospects came up many. The main prospects concern outsourcing of intermediate warehousing, improvements of delivery punctuality and information systems and moving the transportations from road to rail. 20 % of the companies do not need or see any changes in future.

7 Transportation system opportunities

7.1 Intermodal transportation system

An intermodal transportation system is defined as a transportation, where a unit of cargo is transported from origin to destination using at least two transportation modes and the cargo unit is not unloaded during the route. The intermodal transportation system is used in long distances in general. The cost effective distance begins from 400 – 500 kilometres. The intermodal transportation system is general in USA, Canada and in Europe. In Europe the competitiveness of the intermodal transportation is better than in Sweden or Finland, because of smaller trucks. In Sweden and Finland the maximum weight of a truck is 60 tons and in Western Europe it is 44 tons.

However, there are plenty of experiences both in Finland and Sweden regarding the use of intermodal transportation system. Woxenius' article "The Dalecarlian Girl" describes well the situation in Sweden.[8] In Finland two transportation companies have experimented intermodal transports and taken into use intermodal transportation system.

Description of Light-combi concept

The Light-combi intermodal concept was based on fixed train sets with several sidetrack terminals. The distance between terminals is approximately 100 kilometres. At the terminals,

[8] Woxenius J., Bärthel F. The Dalecarlian Girl – Evaluation of the implementation of the Light-combi concept.

swap bodies are transhipped under the overhead contact line using a forklift truck. The truck is carried by train and operated by the train's driver. The Light-combi concept was designed to grocery supply chain, which is very challenging sector for the rail transportation. The structure of the transportation system was based on three central terminals and 22 line terminals, called light-combi terminals. Stop times at every light-combi terminal was designed to be 30 minutes.

The Light-combi concept was important to test because of small-scale environment and for particular supply chain. Technically the concept worked well.[9]

Description of Transpoint Oy's system

Transpoint Oy Ab is using intermodal transportation on two routes: 1) between Helsinki and Oulu, and 2) between Tampere and Oulu. The transportation system of Transpoint's intermodal transportations is simple. It is mainly carried out by roll-on-roll-off system. In this technique articulated vehicle is driven on a chassis wagon of a train using a ramp or a drive dock. The chassis wagon is built to be low. Thus there is no need for a crane or a crane forklift in handling, what then decreases loading costs. The handling is also quick. In intermodal transportation Transpoint uses old trucks, whose investment cost has already been paid. That way the cost of intermodal transportation is low. There is no truck driver included in railway transportation.

Intermodal transportation experiment

Intermodal transports were experimented in the transportation between Italy and Finland. In the experiment, two separate back-and-forth transports were conducted in 1999 and 2000. A so-called bimodal trailer was used in the transportation. The trailer is an American product called Wabash RoadTrailer. In the turn of the millennium, there was one commercial operator of intermodal transports in Germany called Bayerische Trailerzeug. When a system is built as bimodal, it means transportation between two transportation modes. Concerning the Wabash RoadTrailer, it means transportation between train and truck. In this technique there is used a trailer and support bogies connected separately under the trailer. Two trailers are connected with each other with the support bogies. Thus two trailers need three support bogies. When the trailer is situated on the support bogie, its bogie with air spring suspension will be lifted up. Also the stands situated in the forepart of the trailer are lifted up during the railway transportation. Therefore the system does not use wagons as the trailers work as wagons with the help of support bogies. Loading using this technique is quite slow; locating one trailer on the support bogie takes five minutes. Locating another trailer on the support bogie and connecting it to the first trailer takes about eight minutes. The work requires at least two employees. Thus the system requires investment on trailers and support bogies. The bimodal experiment between Italy and Finland was discovered successful and the costs were almost

[9] Woxenius J. Bärthel F. The Dalecarlian Girl – Evaluation of the implementation of the Light-combi concept. P. 11.

similar with road transportation. The advantage of the bimodal transportation was lower environmental emissions. [10]

Containers and other units

Containers are standard transport units that have dimensions, hardness and carrying capacity defined. Containers are usually handled to the corner objects by lifting. Corner objects are standard shaped and located in standard places. There are 20 and 40 feet containers that are the basic units in sea transportation. Number of handling and capacity are announced in TEU-units which come from Twenty foot Equivalent Unit. There are also other standard containers in market but they are more limited than the basic containers. For example Stora Enso has began to use their own containers called SECU (Stora Enso Cargo Unit) which can be handled by the same handling equipment and vessels but the maximum net weight is 80 tons.

Swap bodies are designed for road and railway transportation. The main idea is to maximise the efficiency of transport capacity. Swap bodies have been standardised all over the Europe. There are swap bodies that have feet, and units that can be laid on the ground. The newest swap body standards are made to be possible to pile up the units. Part of the units are equipped with locking objects in bottom of the unit or in corner objects which are similar than container's corner objects.

Semi trailer is a transport unit that has own wheels. Semi trailer can also be transported on a vessel or railway wagon on its own unit or with lorry.

Railway wagon can be heavy unit if the wagons are delivered as such and there is another transport mode included in transport chain, for example a vessel with features to be able to load wagons onboard. A company called Searail is one of the companies that have traffic between Turku and Stockholm. Wagons must be equipped with changeable axels.

There are also a lot of different heavy units in sea traffic, for example ferry wagon, cassette or other carrying units.

Transportation systems uses more and more containers. The use of containers has increased because of development of material handling equipment. The following figure illustrates the increase of containers in recent years.

[10] Mäkelä T. Bimodaalijärjestelmän käyttömahdollisuudet Suomessa. Liikenne- ja viestintäministeriön julkaisu 22/2000.

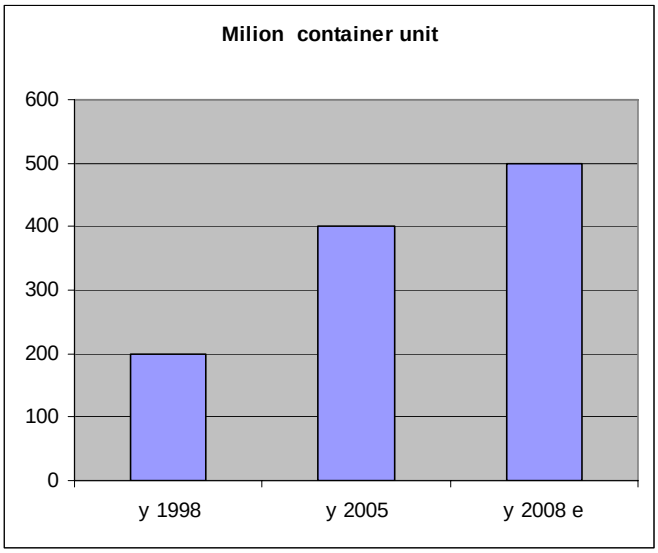

Figure 8 Container transportation in ports worldwide

7.2 The influence of the port of Vuosaari

The port of Vuosaari will bring some more capacity to Finnish ports. The construction of the port has started in 2003 and it is due to be ready in the end of 2007. The port is mainly meant for heavy units such as containers and trailers. All the port operations from Länsisatama and Pohjoissatama will be transferred to Vuosaari. Those freight traffic operations related to passenger traffic will remain at Eteläsatama, that is, at Katajanokka. The materials handling will be fast because there will be only heavy units. It can be estimated that the port of Vuosaari will affect transit transportation and will thereby take over some of the market share of ports of Kotka and Hamina. In addition, the container port might have an effect on inland transportations by transferring transports from roads to railways. This would have a positive effect on the development of intermodal transportation.

7.3 Prerequisites for an intermodal transportation system

The basic prerequisite for forming an intermodal transportation system will be distance. At the moment in Finland the distances of intermodal transports are 500 – 650 kilometres. In Germany the system works both in north-south and east-west directions. The shortest distances are about 300 kilometres and the longest about 700 kilometres. The system operated by Woxenius is meant for intermediate distances of 200 – 500 kilometres.[11] The technical solutions of intermodal transports have developed strongly in the past few years. USA, Germany and Sweden are forerunners in the technical development. There is a strong possibility that in the coming years short distance intermodal transports can be implemented in Finland too.

[11] Woxenius J. Intermodal Freight Transport – urban impact of new network operation principles and transhipment technologies, p. 8.

Materials handling is strongly bound to distance. The materials handling has to be coherent both in the national traffic and between national and international traffic. In this case, the above-mentioned Wabash RoadTrailer is not a good solution.

The materials handling at terminals have to be compatible with road and railway transportation. In addition the materials handling has to be cheap and fast.

One of the significant prerequisites is material flow. There has to be enough material to transport in the junction points. Loading and unloading have to happen every workday. In addition the material has to be suitable to be transported by different transportation modes. According to regulations, food supplies need strict temperature limitations in the transportation chain. Thus the transportation of food supplies by intermodal transportation might be expensive to implement. Durable consumer goods, productive goods and supplies are the best product groups for intermodal transportation.

In Finland intermodal transports should be implemented on base lines at first. At the same time, the arrangements of the main junction point have to be fluent. The schedules have to be formulated carefully and the terminal times have to be short.

The system has to be able to formulate variable trains in order to be able to load and unload trains in intermediate terminals.

Nowadays time window constraints and the availability of alternative routings of intermodal transport pose additional challenges.

Another essential prerequisite for intermodal transports is the size of a transportation company. The bigger transportation company the better possibilities it has to offer and implement extensive transportation services.

Related to planning and control of transports, shipment splitting is an important factor. The more shipments have to splitted in the chain, the more expensive the transportation will be.

The consigner should evaluate transportation possibilities more versatile as far as the consigner plans the transports. Intermodal transports bring evaluation of many objectives; especially total time of transportation, minimizing costs and/or maximizing service.

7.4 Potential material flows and change of directions by influence of intermodal system

There are potential material flows especially in raw materials and products of metal industry and sawn timber and wood products. Possible return transports are roller cages, pallets and plastics boxes.

The amount of material flow is usually evaluated by a share of some total amount. For example, the amount of goods to Seinäjoki totals 400 000 tons a year and about the same amount goes out. From this amount about 10 % can be evaluated to transfer into intermodal transports. The transferred amount would then total 80 000 tons. If links to ports in the nearby area will improve more flexible and the prerequisites of the intermodal transports will be implemented, the material flow can be doubled. Let's assume that heavy units have a payload of 25 000 tons in average. According to this, 3 200 heavy units would be needed in a yearly basis. In a day, 10 handlings of heavy units would make forming of one distribution or collection train possible.

In Jyväskylä the amount of goods will be the same. It has been noticed that the route Oulu – Helsinki is working fluently in intermodal transports because heavy unit transports have increased. In future Oulu – Helsinki or Oulu – Tampere track can be utilised better. This would decrease the amount of road transports from Oulu to Helsinki via Jyväskylä.

Russia is traditional plywood producer. For instance Swedish packaging manufacturer Supply Nefab purchases plenty of plywood from Parfino and other places of Russia. Parfino is locating near St. Petersburg. Traditionally, the transportation goes by road through St. Petersburg to Turku via Vaalimaa and from Turku to Stockholm by ferry. And finally from Stockholm to Alfta by road. An alternative mode would be railway from Parfino to Alfta without any intermediate material handling. The route would then be Parfino – St. Petersburg – Kouvola – Oulu – Haaparanta – Alfta. Would it be less expensive? Another possible route would be Parfino – St. Petersburg – Kouvola – Turku – Stockholm – Alfta requiring two material handlings within the route, one in Turku and another in Stockholm.

Appendix 1 sketch different route alternatives. These routes are based on railways.

8 Base for the strategy

Today's logistics trend is to concentrate the transports to certain routes and corridors to ensure the competitiveness. These corridors and related terminals direct the companies to locate near and within the core networks. This makes the improvement of transport corridors and terminals even more important.

Goods traffic and data communications and strong county centres are the base of the competitiveness of different areas in future. National migration has long been directing to population centres and a couple of growth centres. Jyväskylä area is one of the five fastest growing regions in the beginning of 2000 century. Seinäjoki is in good position regarding the intermodal transportation. Seinäjoki has a good possibility to grow to an important terminal area.

8.1 Design of an intermodal terminal in Jyväskylä or in Seinäjoki

Space requirements

The intermodal transportation terminal of Oritkari port in Oulu can be seen as a model to an intermodal transportation terminal to Jyväskylä or Seinäjoki. The terminal of Oritkari has been in use since January 2004. The whole area is 20 hectares but the track and loading area is about 700 metres long and 200 metres wide. The track area is about 30 metres wide and the tracks consist of three track pairs. Both sides of the track area there is space for loading.

In Jyväskylä area an intermodal transportation terminal has been planned to locate either by the roadside of Laukaantie in Pieleslehto area or in Vaajakoski. There are also other possible options. At the moment the most important goods traffic terminals are located in Seppälä area and at the crossroad of Kangasvuorentie and Laukaantie. In Seppälä are located the terminals of Vähälä-Yhtiöt Oy and Transpoint Oy. The Seppälä area is draw planned for retail trade and service companies. The facilities of Transpoint Oy have become very narrow. The terminal of Vähälä-Yhtiöt Oy is functional and there is a blind track connection from Jyväskylä railway yard. This blind track has been utilised in the experiment of intermodal transports in 1999.

The intermodal transportation terminal to be planned requires at least two track pairs with a connection to both directions. In addition drive ramps and loading docks are needed. In this case there is no specification for the terminal building, only the space requirements for one goods traffic operator are concerned. The size of the terminal site of Vähälä-Yhtiöt Oy is five hectares and the size of the terminal site of Transpoint Oy is three hectares. The three hectares is way too small to fit with the present operations. At the moment, the five hectares is enough for Vähälä-Yhtiöt Oy. Thus the new terminal requires at least six hectares' space regarding future extension. The terminal should have at least 4000 m^2 of warm space, about 3000 m^2 cold space and according to the needs of food industry some freezer space.

In addition to the above-mentioned, several service business activities require space. Related to transportation and terminal operations the most important are fuel distribution and facilities for materials handling. Sale and mounting of tyres are also important. Repair service for vehicles should be found in the area too.

The cost of terminal and rail plant construction

In this case there is no possibility to specify costs in details but the magnitude of costs can be given. A good basis for this is the construction costs of Oritkari terminal in Oulu, which totalled 7,3 million euros. The Oritkari project included the procurement costs of the 20 hectares area, public utility services and terminal rail plant with docks and loading areas.[12] The area being port area that requires careful and thorough base work mainly causes this big cost. When constructing on a good soil, the cost of base work is 10 €/m^2 with the cost of public utility services added to this. Still the rail plant has the highest share of total costs. In Jyväskylä and

[12] www.ouka.fi [Viitattu 14.4.2006]

Seinäjoki, two track pairs would be enough and area smaller than in Oritkari then the costs would also be lower than in Oritkari.

In Seinäjoki, an intermodal transportation terminal or only a loading possibility will be a challenge. This is caused by the fact that at the moment both Transpoint Oy and Kuljetusliike Auramaa Oy are located in Kapernaumi area. The terminal of Transpoint Oy is located at Tehtaantie 22 and the new terminal of Kuljetusliike Auramaa Oy is located at Tehtaantie 33. The distance to the rail yard is about one kilometre. There is a sidetrack to Kapernaumi that ends at Tehtaantie 12. If there is a possibility to use the sidetrack and even possible to extend the sidetrack, the intermodal transport could be possible.

The terminal of Kaukokiito Oy in Voutila, Vantaa, can be considered as a basis for the construction costs. The total cost of the terminal was 11,5 million euros. There is 12 500 m^2 of terminal space and 2 000 m^2 of office and social space. The operations of the terminal are based on the flow type I. There are 100 loading docks that are situated in both sides and ends of the terminal.

The construction costs of the terminal roughly consist of:

- Procurement of the area 5 €/m^2
- Yard work 10 €/m^2
- Public utility services 400 000 €
- Rail plant and docks 4 500 000 €
- Terminal building 800 €/m^2

A terminal building with its areas would form an investment cost of seven million euros. In addition rail plant, docks and ramps would form a cost of 4,5 million euros. The electricity cost is the largest cost element in constructing side track.

Financing

The financing of an intermodal transportation terminal and rail plant can follow the same pattern as in Oritkari. Same kind of solutions can be considered. The Oritkari terminal area is financed by the city of Oulu, Ratahallintokeskus, VR Cargo Oy and Technology Centre of North-Bothnia whose share is financed by government and EU. Ratahallintokeskus has financed the project by 4,5 million euros, VR Oy by 1,8 million euros and Technology Centre of North-Bothnia by 0,8 million euros from the EU target 2-program. The rest was financed by the city of Oulu who was responsible of the public utility services and the procurement of the area.

A same kind of solution is to establish a co-operation company by the companies involved in the project. This co-operation company will collect the starting capital. The co-operation company can also work as a builder of the project. The Oritkari terminal was a very central part of the development of the city of Oulu, that’s why there were no other municipalities involved

in the project. In the Jyväskylä area and Seinäjoki area, the nearby municipalities could participate in the costs. In addition, a company called Jykes Kiinteistöt Oy can rent or have built premises for companies' needs. A good example of a wide co-operation project is Suomen Matkakeskus where there is Liikenne- ja viestintäministeriö, municipalities, Ratahallintokeskus, Tiehallinto, Linja-autoliitto. Oy Matkahuolto Ab, Suomen Paikallisliikenneliitto, Suomen taksiliitto ja VR Osakeyhtiö involved.

The third financing model is an investment company that collects the construction capital and has the terminal built. After the terminal is finished, the investment company rents the facilities to forwarding and transportation companies and other logistics operators or service companies.

Traditionally, the constructing decision is made based on benefit/cost ratio. When the ratio is over 1 then it would be attractive for investors.

8.2 Influences

In the past ten years, new products have strongly penetrated to the market and the growth is still continuing. Basic raw materials are sold and purchased more and more between countries. That causes the transportation volumes to grow. New ship connections have been established to the sea traffic between Finland and Germany by increasing the amount of ships. The ships are transporting more and more containers. The increase of using containers has been strong. The new port of Vuosaari will possibly increase the use of containers also in the inland traffic. This would have a positive effect on the growth of railway transportation.

Same techniques at railway stations and ports, where the change of containers to another transportation mode is made, will decrease material handlings costs. Integration of operations will be obvious. This has been achieved through designing processes in a new way.

The logistics departments of companies try to build their supply chains as low cost as possible. The supply chains will be physically long that then requires several transportation modes. The companies build their transports by optimising them based on the information available. The more we know about transportation linkages the better and more inexpensive the transports can be implemented. The control of transports is transferring more and more to big transportation companies what enables industrial and commercial companies to acquire the transports as a full service from one provider. Thus the big transportation companies are the key players in forming transportation synergy.

Nowadays big industrial companies have better and better planning systems, for example optimisation and simulation tools. Logistics planning with the help of these kind of tools helps to lower the costs. The price of a certain links affects lowering the transportation costs. The optimisation usually finds minimum costs of certain links. The industrial companies should be more informed about availability and price level of different transportation systems.

If intermodal transports will increase inland, both in Sweden and Finland, it will decrease long distance road transportation. Truck transportation would thus include mainly distribution and collecting on certain terminal area.

The intermodal transports will increase. Transferring to intermodal transportation system is affected by the high price of oil, development of railway and road network based on classification, development of materials handling equipment and reasonable control of railway transports. The classification of railway and road network forms a core network that enables fast transportation.

Transferring goods transportation more and more on railways will naturally decrease environmental emissions.

Functional transportation systems operating both on linkage level and on technical level of transportation equipment will help the development of trade between different countries.

8.3 Suggestions for actions

We suggest that strategy statement would consider the time span of ten years and twenty years and would emphasize the use of railways and the use of intermodal transportation would be based on main routes. At the same time the position of ports of the Gulf of Bothnia should be strengthen.

A further research should concentrate on finding material flows fitted to intermodal transports' prerequisites. Assumingly they should be found from traditional cargo because of the use of containers. In addition, material flows that can be gathered in a specific terminal to a one load and unload in a destination, distribution taken into consideration as well, should be found.

The strategy should stress a strong improvement of intermodal transports. Calculations and pricing should be formulated at the same time. The next step is to conduct an optimisation with selected materials both nationally and internationally.

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