Olli-Pekka Hilmola & Eugene Korovyakovsky (Editors)

NORTH-EUROPEAN LOGISTICS IN THE ERA OF GLOBAL ECONOMIC TURMOIL

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TEKNILLINEN YLIOPISTO

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North-European Logistics in the Era of Global Economic Turmoil

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Foreword

As we know well, transport logistics is entirely dependent on the global economic conditions and especially it is driven and fuelled mostly through international trade. Actually transport logistics is the derivative of economic growth, and mainly accelaretes considerably higher base with the growth of the latter factor. During the recent year we have faced one of the most serious modern time declines in global GDP as well as in manufacturing activity; these two main factors, among currency changes and increasing unemployment, have caused dramatic declines in transportation volumes, and volume allocations. Future does not currently look that bright in the transport logistics sector, since under utilization of current fleet (e.g. sea vessel capacity and used long-term infrastructure) accompined with already completed orders (supplied during the forthcoming two to three years) will create harsh business environment with low prices for the entire sector for years to come, if growth will not come back quickly on the real economy. Thus, it is very unlikely that we would go back to good old globalization days during forthcoming years. However, as researchers, looking blindly forward, we see clearly opportunity in here within changing conditions – now nation-wide organizations, governments, municipalities, cities and business sector could start to reconsider used concepts and systems once again, and possibly changing towards environmentally friendly direction. We argue that railways and intermodality, used in appropriate manner, could ease our environmental load considerably, and decrease the dependency on fossil fuels.

This book contains more than 20 research manuscripts from the area of transport logistics – what is amazing in all of these works, is the requirement of something new and fresh for the current situation. Either we need more co-operation between actors or countries in a case of crisis, and/or we would need new technological solutions. These latter solutions are typically combination of both hard (investments and machines) and soft (management, specialization and organization), which together would enable needed change in current situation. However, as some of the articles in this volume illustrate that initial investments on transport logistics are not small-scale either – new structures will cost a lot to be constructed, and therefore should be carefully evaluated and planned. It seems to be the case that transport logistics demands more intenelligence and accuracy from about to be completed decisions; these could be gained through e.g. computer simulation systems, but as showed in the book too, operative information systems will modify larger sector actors in the future as well.

Finally we would like express our gratitude for the city of Kouvola of arranging this research seminar among larger Innorail meeting – this two day event facilitates the exchange of knowledge and ideas as well as gives us good opportunity to develop and shape the future. During this year our meeting actually consists additional day more, since some of the articles in this volume are by-products of EU project called Stoca, which concerns transportation logistics in the case of emergencies and crises – project, which is 'just in time' with regard of current economic situation. Last, but not least, we would like to express our gratitude for Tarja Mustonen, Sanna Tomperi and Jouko Karttunen from assistance in arrangements of this event.

In Kouvola, Finland & St. Petersburg, Russia during May 2009,

Olli-Pekka Hilmola
Prof. (act.), Docent, PhD

Eugene Korovyakovsky
Head of Department, Dr.

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Development and future prospects of Finnish transit to Russia

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Abstract
The eastbound transit to Russia has importance to Finnish national economy and economy of the Kymenlaakso region. The ports of Kotka and Hamina handle approximately 60% of Finland's eastbound transit volumes in tonnes (2008). The volume of transit has increased steadily since 1998, but the current global economic slowdown has impacts also on the new estimates of the near future (2010–2012). The impact of transit traffic on national economy was approximately 380 million Euros in 2007. Estimates of the impacts on employment vary between 3 000 to 5 000 work years in 2007. The transit traffic sector is highly competitive. This is due to a large number of small transport companies and dominant national monopolies, particularly in rail transports. In addition, transit routes "compete" with each other. The Finnish route is considered a reliable and safe alternative compared to routes in Central-Eastern Europe and the Baltic countries. The value-added services are also well developed resulting into a competitive cost-benefit ratio of the Finnish route. Our research results indicate that the eastbound transit is more significant compared to westbound transit due high-value of the transported cargo. Westbound transit includes more bulk products. Furthermore, reliability is a necessity for the transit of high-value goods such as cars, electronics and machinery. In 2008, approximately 850,000 cars were exported to Russia via Finland. This equals an amount of 97 cars (or 1.5 cars per minute) each hour around the clock for the whole year. The Finnish route transits nearly 15% (over 30 billion Euros) of the Russian import value. Russia's new ports that are under construction will have an important structural effect. In this paper we present the latest statistical figures and future trends in Finnish-Russian transit. Our data includes the latest figures of the year 2008.

Keywords: Transit, physical logistics, transport, Russia, Finland

1. Introduction

The transit from Finland to Russia has significant importance to the regional economy of South-East Finland. Ports of Hamina and Kotka handle approximately 60% of Finnish eastbound transit volumes. Until the year 2008, strong growth in the Russian economy supported expansion of volumes in terms of value and TEU (transit equivalent unit of 20 feet container). The benefits of transit to national economy include net income of 380 million Euros and employment of approximately 3,000 persons. The total costs have been estimated to be approximately 30 million Euros (Helminen et al. 2007: 50–57; Ministry of transport and communications 2008). In the Kymenlaakso region, the relative importance of transit is considerably higher than national average.

The competition between international transit routes is hard. Each route has their strong points as well as weaknesses. The Finnish routes (via South-East Finland and Kymenlaakso) are safe, reliable, and have high standard value-adding services and logistical know-how (Hernesniemi et al. 2005; Inkinen & Tapaninen 2009; Märkelä & Jumpponen 2007). The

competition between the routes is now in its turning point. An influential factor is Russia's goal to develop its ports and to offer a direct sea link to importers cutting down the amount of road transit volumes (Ministry of transport of Russian Federation 2008; Ministry for economical development of Russian Federation 2008).

Until the recent months, the transit volumes from Finland to Russia have steadily increased with a high growth rate. The near future prognosis of the Finnish transit to Russia has been that transit volumes will be cut down due to the development of Russian infrastructure and services. In our paper we will examine the development and future trends of Finnish-Russian transit. Our paper uses latest statistics on transport and transit together with detailed information concerning Russian port volumes.

2. Russian economy indicators

The development of the Russian economy is fundamental to the development of Finnish transit. The annual growth has varied from 5% to 10% since the year 2000. Strong growth has been supported by the increase in global market prices of oil and natural gases. The Russian economy is to a large extent based on these natural resources. However, the current global economic crisis has decreased the growth estimate for the year 2009 so much that it is negative. Estimates vary between -2% to -5% in annual growth. Still, the total value of Russian imports has increased 6.5 times from 45 to 292 billion USD during 2000–2008.

The rapid growth in the Russian economy has also increased purchasing power and consumption of consumer goods. Particularly the demand and imports of consumer durables such as vehicles and electronics has increased. These items are also the main transit goods trespassing Finland to Russia. (Ruutikainen & Tapaninen 2007: 14; Spiridovitsh 2009: 9; Sutela & Hanson 2008: 2). In long term estimates concerning the Russian economy, the greatest risks concern the dependency on global market prices of oil, natural gas, metals and raw wood. Sustainable and steady growth would require the development of a broader scope of industries. These include development of services, retailing and construction. (BOFIT 2008: 2–3; Central Intelligence Agency 2008; Juurikkala et al. 2006: 6–8; Spiridovitsh 2009: 9–10).

The economic crisis that originated on the US real estate markets and global finance impacted Europe and Finland in the autumn 2008. The global economic recession has had an impact on Russian imports as well. The estimates have been declining since the first forecast

by Russian ministry of economy and finance that stated the decline of annual growth in 2009 to be reduced 0.7% from 2008. However, since then the estimate has decreased to the latest estimate figure of negative growth of -2.2%. This equals a drop of approximately 7%. International economic organizations estimate the annual growth even lower. (International Monetary Fund 2009; Ministry for economic development of Russian Federation 2008; BOFIT 2009).

Table 1 shows selected key figures describing the Russian economic development with estimates to the years 2009 and 2010. The strong growth of the Russian economy can be seen particularly in increases of salaries, GDP and investments. Furthermore, an important aspect is the decrease in the foreign debt from 2005 to 2008.

Table 1. Economic indicators depicting the Russian economy. (BOFIT 2008-2009; Spiridovitsh 2009).

	1998	**2005**	**2006**	**2007**	**2008a**	**2009e**	**2010e**
GDP (bill. USD)	132	764	985	1 290	1 645	1 235	1 443
Annual change in GDP (%)	-5,3	6,4	7,4	8,1	5,6	-2,2	3,0
GDP/capita (USD)	900	5 350	6 910	9 060	11 600	8 730	10 240
Unemployment rate (%)	13,2	7,7	6,6	6,1	6,1	6,8	6,2
Average salary (USD)	108	301	408	550	608	-	-
Consumer prices average change (%)	-	12,7	9,7	9,0	13,3	12,5	9,0
Investments (change %)	-12,0	10,6	17,5	20,8	9,1	-14,0	5,0
Private consumption (change %)	-	12,2	11,1	12,9	11,7	1,0	5,8
Industrial production (growth %)	-5,2	5,2	5,9	6,3	-2,0	-7,4	0,7
Primary production (growth %)	-	2,4	2,5	3,6	3,2	-	-
Inflation (%)	84,4	10,9	9,0	11,9	13,3	13,4	9,4
Balance of current accounts (bill. USD)	0,2	83,3	94,5	78,3	98,9	-49,9	7,0
Exchange rate RUR/USD	20,7	28,3	27,2	25,6	24,9	34,5	35,3
Exchange rate RUR/EUR	-	35,2	34,1	35,0	36,3	44,3	45,9
Exports (bill. USD)	74,4	243,6	304,5	355,2	471,8	316,5	405,2
Imports (bill. USD)	58,0	125,3	163,9	223,1	292,0	274,7	306,4
Foreign debt (bill. USD)	-	70,1	43,2	35,8	31,1	-	-
Population (mill.)	147,8	143,5	142,8	142,2	142,0	-	-

Russia is one of the significant countries in global economics in absolute terms. Measuring the GDP level in absolute terms, Russia was the 11th largest economy in the world. In GDP per capita measurement the position is considerably lower (59th). Russia was ranked 58th in the World Economic Forum's Global Competitiveness Index in 2007. Key obstacles on

the development path of the Russian economy are related to institutional arrangements and deficits together with underdeveloped financial markets (World Economic Forum 2008). Russia has set goals high concerning the economic development (Table 2).

Table 2. Goals set by the Russian ministry for economic development 2007–2020. (Ministry for economic development of Russian Federation 2008).

	2007	2020
GDP/capita (1000 USD)	13,9	30
Average age (a)	66,5	72–75
Annual GDP growth (%)	8,1	6,5
Size of the middle income class (%)	20	> 52–55
Exports (bill. USD)	354	> 900
Growth in labour productivity (%)	1	2,6
A share of innovation industries (%)	5,5	25–35
Exports of machinery industry (bill. USD)	19,7	110–130
Russia's share of global economy (%)	3,2	4,3
Share of national products in consumer demand (%)	50 %	80 %

The goal is by the year 2010 to increase the GDP per capita level 20 times higher than it currently is. In addition, the size of the "middle class" is targeted to grow from the current 20% of population up to 50%. The import and export levels are also targeted to be increased considerably via the development of Russia's own refining of goods and products. These projections would mean a great challenge for transit businesses in Finland and other neighbouring countries.

3. Finnish transit

The rapid and strong growth in the Russian economy has been an important backbone in the development of the Finnish logistics industry. These concern particularly through-transit to Russia. Even though Russia has extensively developed its infrastructure, the phase has not been sufficient to meet the total increase of imports. This has lead to a considerable increase in transit traffic volumes in Finland that are now, in the midst of global economic crises, rapidly decreasing.

Transit volumes have increased steadily since the 1980s (Figure 1). The decades are showing extensive growth: in 1980 the total volume was below 3 million tons, in 1990 over 5 million tons, in 2000 there was a short period slow down and total volume was decreased to

little over 3 million and finally the rapid expansion period beginning from 2000 has lead to final record of total transit on the level of 8.4 million tons. The future volume development and the effects of the economic slump will be interesting to see. Overall Finnish transit has experienced a triple time growth between 1980 and 2008. This equals an annual growth rate of 10% on linear regression.

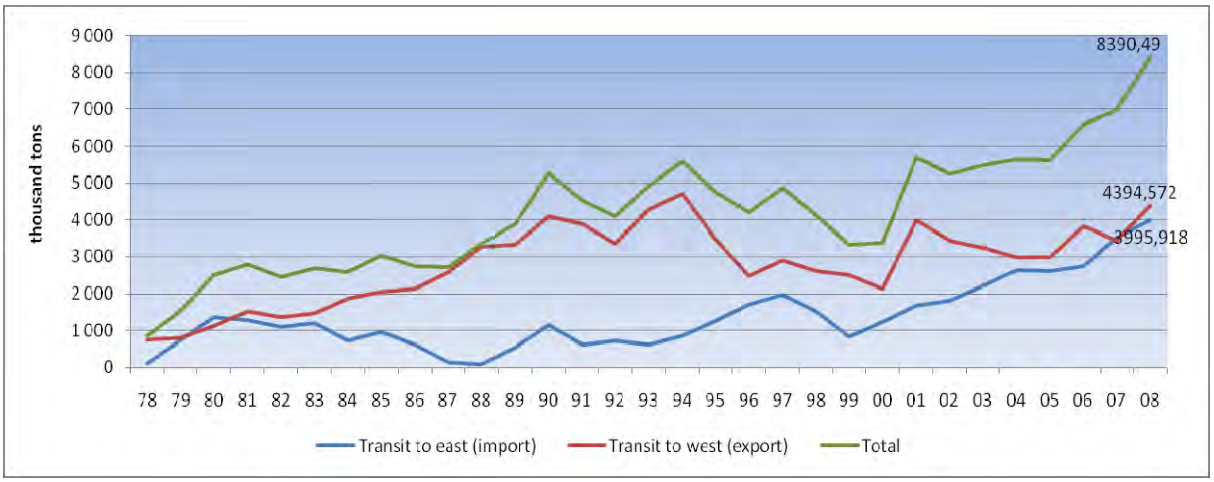

Figure 1. The development of Finnish transit 1978–2008. (Finnish Maritime Administration 2009a; 2008b).

Figure 1 clearly shows the Russian currency crisis in the late 1990s that decreased the level of eastbound transit by more than 2 million tons (Widgren et al. 2000: 46–47). Another interesting direction of development seen in Figure 1 is the difference between east and westbound transit. It was not until the 2000s that Russian transports reached the level of Western traffic. Considering the larger picture of Finnish national economy, the volume of total foreign trade in 2008 was 102 million tons. The amount of transit out of this figure is about 8% and the relative importance of it has increased since the year 2000. (Finnish Maritime Administration 2009a; 2008b; 2008d).

Eastbound transit consists mainly of high-value goods from the European Union to Russia (Lautso et al. 2005). In 2008, approximately 13% of Russian import value was transported through Finland. Transit is multimodal: containers reach Finland commonly via sea and are then delivered to Russia with road transports. In Figure 2 we display the main corridors of Finnish transit. Figure 2 demonstrates the volume distribution between the main nodes of transit routes.

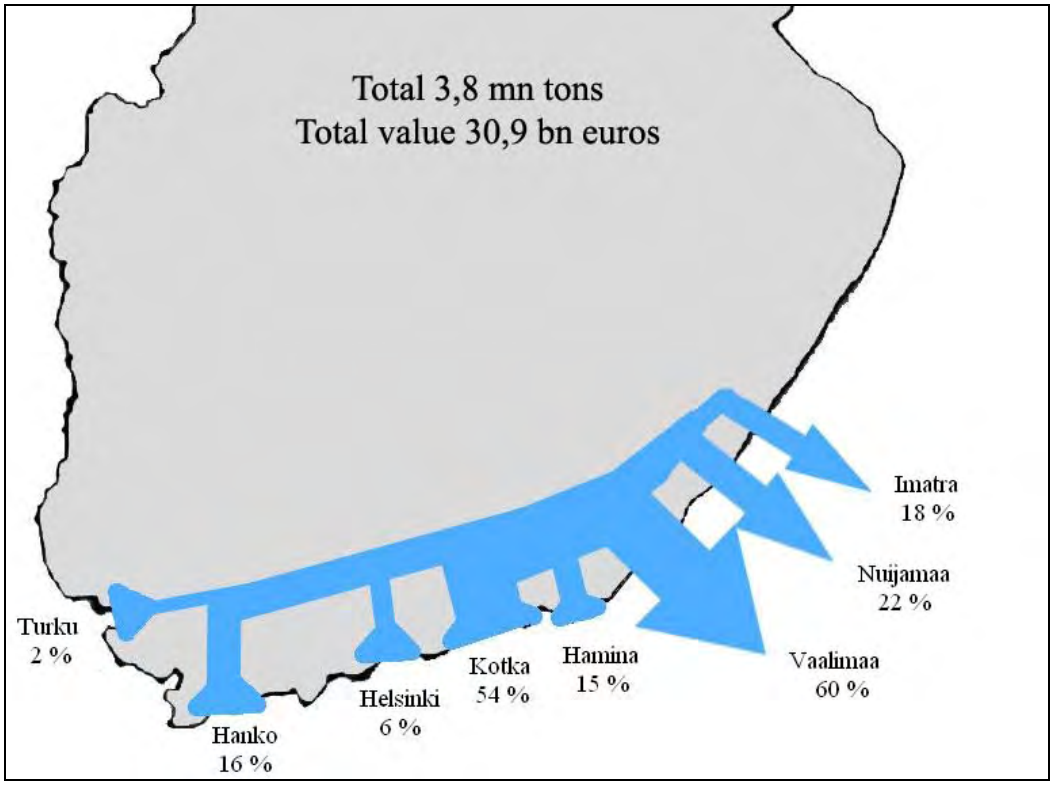

Figure 2. Finnish eastbound transit routes and volume distribution between main ports and boarder stations in 2008 (Finnish Maritime Administration 2009a; National Board of Customs 2009a).

Figure 2 clearly demonstrates that the major ports in Southern Finland include Hamina, Hanko, Helsinki and Kotka. Also the port of Kokkola on the Northern part of Gulf of Bothnia has a significant transit volume. The port of Turku has the least volume concerning eastbound transit (2%). The highest share of port imports is held by the port of Kotka having an over 50% share of total volume. Imatra, Nuijamaa and Vaalimaa are the boarder crossing zones. Vaalimaa has the highest share of 60%. The high volumes transported through Vaalimaa have had impacts on public road safety due to long (over 60 km) truck queues in South-East Finland. We further elaborate the structure of Finnish transit volumes according to the development of incoming tons 2003–2008 in the main ports. The selected ports in Figure 3 are Hamina, Hanko, Helsinki, Kokkola, Kotka and Turku. The ports of Kotka and Hamina have traditionally been significant ports for Russian transit.

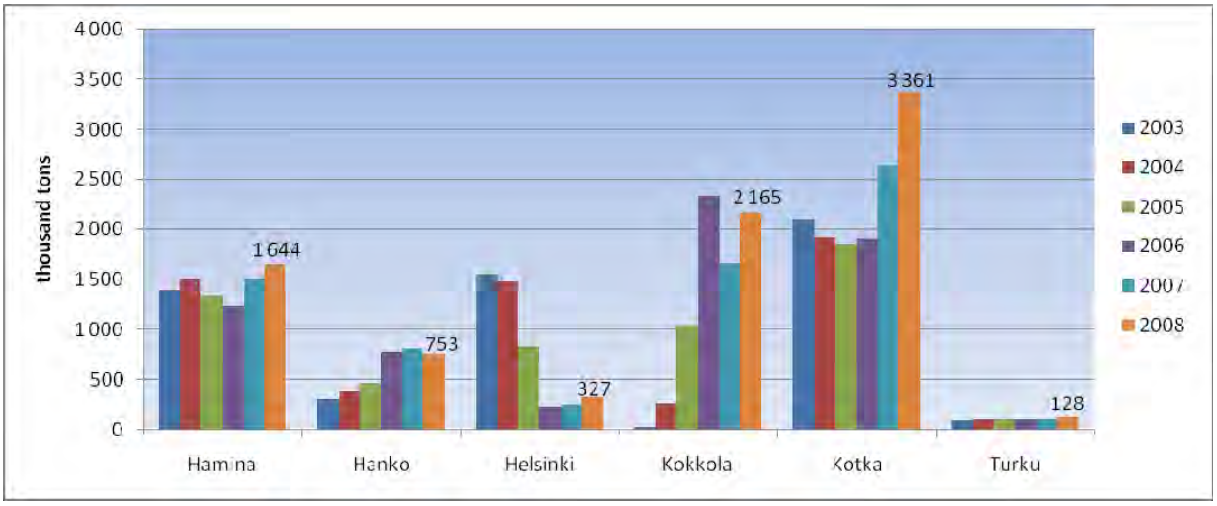

Figure 3. The development of transit volumes in major transit ports 2003 – 2008. (Finnish Maritime Administration 2009b, Finnish Port Association 2009a).

The development of volumes in Kotka 2006–2008 is an important single observation from Figure 3. The growth has been exponential compared to other ports that have experienced rather stagnant or linear growth. The port of Hanko has also experienced significant growth that has, however, leveled out since 2006. The high growth in Kotka is explained to a large extent with the decrease in the port of Helsinki, in which the transit volumes have declined dramatically in 2006. Considering relative portions of transit the port of Kotka has a share of 40%, Kokkola 26%, Hamina 20% and Hanko 9% (Ruutikainen & Tapaninen 2007: 29).

The transit volume structure is further elaborated in Figure 4 where the main ports are described in relation to container (TEU) volumes. The picture becomes even more contrasted between the ports. The port of Kotka has experienced an extensive growth of 132% in the six year period. The corresponding decline in Helsinki is also clearly visible. Hamina and Kokkola have experienced quite steady small growth. Practically everything in the container traffic (377 000 TEU) was transported through these ports to the East.

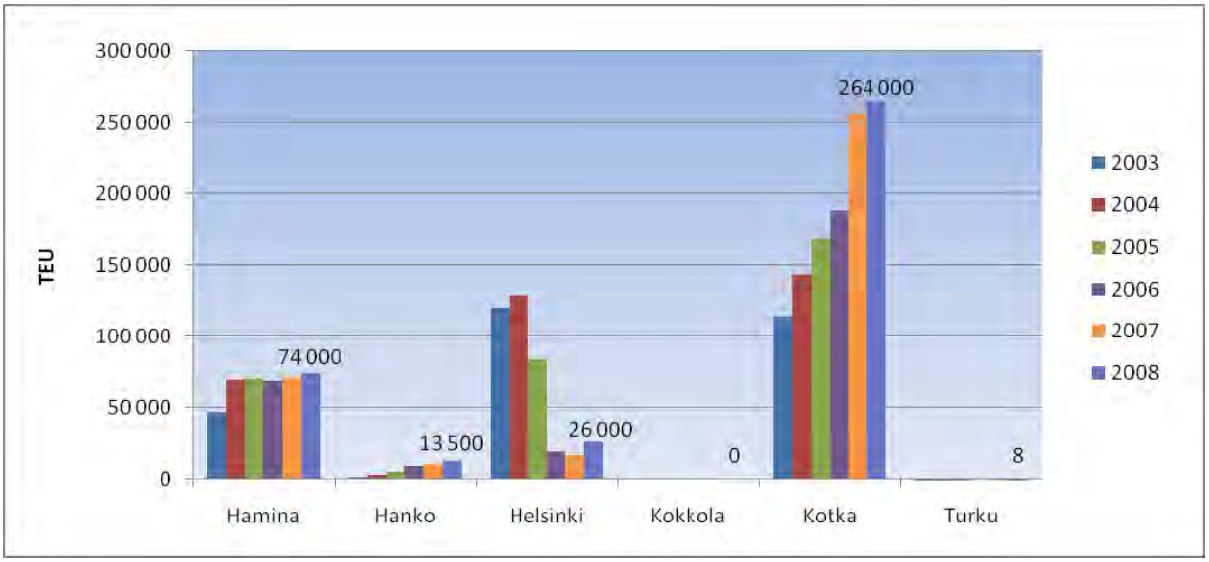

Figure 4. The development of transit in TEUs in major transit ports 2003–2008. (Finnish Port Association 2009a; 2008a).

Transit of cars has become a significant segment of overall transports. In the year 2008 eastbound car transit totaled approximately 785,000 cars. Figure 5 shows that the transit volume has tripled from 2004 till the latest figure of 2008. The main ports in car transit are Hanko and Kotka. Also ports of Hamina (23,000 cars) and Turku (12,000 cars) have a share of car transit. In addition to transported cars some 68,000 were driven to Russia independently.

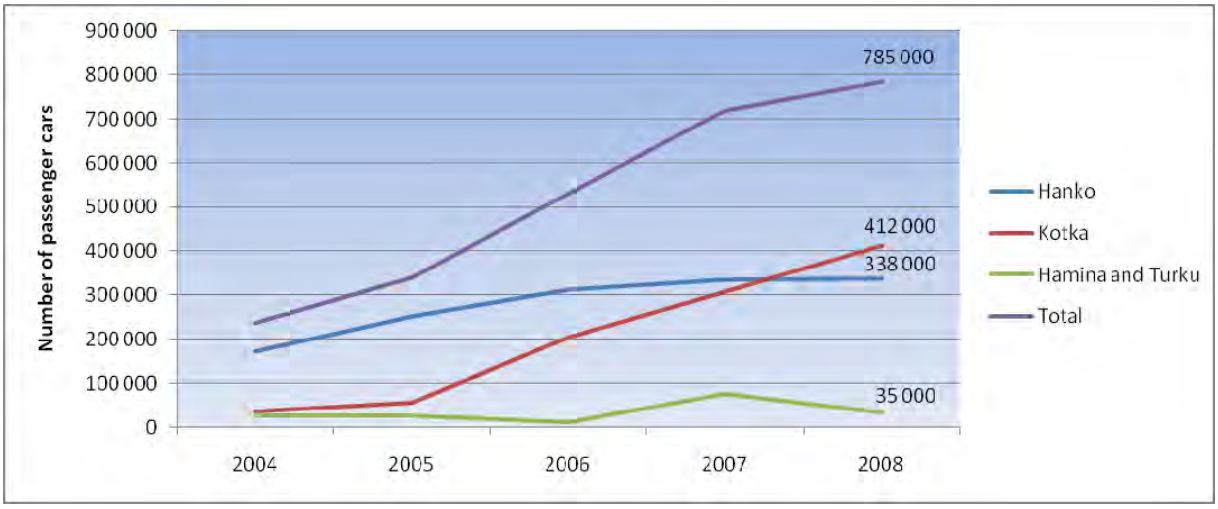

Figure 5. Transit of cars to Russia 2004–2008 (Ruutikainen & Tapaninen 2007: 45;National Board of Customs 2009b; 2008d).

Volumes of rail transit towards east from Finland are rather small. This is mainly due to toll charges and related problems. Considering future car transits, the Finnish national railway company VR has a goal of transporting approximately 50,000 cars annually directly from ports. In Moscow, a new reception terminal for imported cars that has custom operations and capacity for temporary warehousing has been opened. However, functional and regular train connections to Russia have an important role in overall transit development. In addition, also interesting steps of development take place in air cargo and transit: high-value goods fly to Finland and are then further transported to Russia. (Widgren et al. 2000). The future European and Asian transports are estimated to continue to grow in volumes and in value. Particularly products from China to Europe and other parts of the world are estimated to grow. The current economic crisis, however, makes the production of estimates difficult.

4. Conclusions

The development of the overall Russian economy is a main determinant of the development levels of Finnish transit. The Russian economy has grown steadily on the rate of 5–10% annually since 2000. Russia has been one of the most rapidly growing economies in the 2000s. The growth has been supported by the growing need of natural resources of oil and gas that have lead to an increase in global market prices. Russia is one main exporter of these natural resources and the positive impacts have been extensive. The overall value of Russian imports has increased from 45 billion USD over 6 times to 292 billion USD during 2000–2008. This growth has concerned particularly consumer goods such as cars and electronics. However, the latest estimates for the year 2009 suggest even negative growth. The impacts to transit are already visible in import ports of Finland. The delays in investments and increased costs in financial markets have impacted also the transit industry.

The Russian ministry for economic development estimates that the GDP growth in 2009 will vary from -0.5% to 2.4%. The decrease in GDP growth impacts Russian imports. The development in the global market prices of oil is considered to be the fundamental factor. The estimation of the Russian ministry is based on the assumption that the price of oil will level out to approximately 50 USD per barrel (159 liters). In addition, the ministry and Russian national government have been reluctant to change long term estimates of the Russian economy to 2020. A recognized challenge of the Russian economy is the extensive reliance

on natural resources and the dependency on the market price development of oil, natural gas, metals and wood.

Evidently, the fast growth of the Russian economy has supported and benefitted the logistics industry in Finland. There are over 30 different value-added services offered to transit transportations in Finland. Value-added services are concentrated on intangible services, transports, quality management and cargo handling. The most common value-added services are customized customer service, ICT services, documentation, and consulting (Posti et al. 2009). This concerns particularly transit, supportive service and operations. The growth of the Russian economy has been so intense that Russia has not been able to maintain infrastructure needs on the required level. This lack of transit capacity is one of the main factors explaining the growth in Finnish transit. The volumes have almost tripled 2000–2008 and the industry employs some 3,000 professionals in Finland.

The east and westbound transit levels are now on similar levels. The eastbound transit concerns mainly high value goods from the European Union to Russia. The value of transported goods is relatively much higher than the ton volume. Over 15% (over 30 billion Euros) of Russian import value was transported via Finland. These high value goods include mainly private cars, electronics, machinery, equipment and other valuables. The high peak in car transits was in 2008 when approximately 850,000 cars were transported to Russia. An interesting step of development will be the downfall from these figures in 2009 due to the economic slowdown. The westbound transit, on the other hand, includes bulk products and items with low refinement level. These are ores, enrichments and chemicals. Due to the high value profile of east transit, it has more significance to the Finnish logistics industry.

The development and enhancement of Finnish transit requires also development and increased use of rail transports. Current rail transit volumes are low and in the future, it is possible that there is increasing activity in this field of logistics. Rail transit can also be seen as a part of a national route and steps of development in rail volumes benefit the overall condition and competitiveness of the Finnish transit route. However, this requires integration of services that should be available as a “single packet”. Currently, services are dispersed and service purchasing requires more efforts from a client than would be possible in more integrated service models.

Future assessments predict that Finnish transit will remain as one of the key routes to the Russian market. The current economic depression is likely to cause negative growth in the near future but after normalization of market conditions the growth is expected to continue. The Russian infrastructure is insufficient to be able to manage even the current transit loads

and, therefore, the future prospect of the logistics industry in terms of transit probably will continue to develop.

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About the level of development intermodal transportations in Russia and in the world

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Abstract
The article consist two parts: In the first part analysis of intermodal transportation in Russia and in other countries is given, while in the second part the perspectives of contrailer train between Kouvola and Moscow is being analyzed. As a result of the work we can admit that without support of federal government this project becomes unprofitable.

Keywords: Contrailer transportation, innovative transport technologies, Russia, Finland

1. Introduction

Transportation during last decades of time has grown extremely fast, so that highways have become "bottleneck" of transport logistics. According to the information (Hilmola, Saranen, 2008), average speed of delivery of cargoes by means of motor transport in the European Union makes 18 km per hour that is not enough for the present stage of development of the industry. Besides many forecasts (Ministerial council of transport) speaking about the further intensive increase in cargo transportation, however, the world financial crisis is still continuing. In these conditions transportation by rail is becoming increasingly significant and interesting for different parties. Railways are safe, could operate with smaller costs, and produce less harm for environment. As a conclusion about increasing necessity of transportation volumes by rail therefore arises.

With expansion of the European Union to the East; the Central Europe and especially Germany are living through the intensive of increasing transportation in the East-West direction. It is expected that by 2015 the cargo transportation could grow up by more than 60 %. The network of highways in Europe not in such a good condition with regard to cope with such significant increase. Without radical actions jams on roads are obvious in the forthcoming years. The economy incurs milliard losses, because of fuel consumption, loss of time and an ecological damage. We can find these ideas in EU funded project FreightVision 2050. In Russia railway transport is still “quite strong”, so ecological questions are not in the main focus of Transport strategy program concerning year 2020.

On many positions the railway transportation is the competitor for the road transportation; however, it is required to develop a number of actions for coordination and "consolidating" of these types of transport. It is necessary to use capacity of the railway concerning reliable, fast and safe types of transport and availability of trucks to deliver cargoes to/from enterprises.

Basis of the problem decision of increase of an overall performance of railways are cardinal upgrade in relations with users of services of a railway transportation and introduction of technologies of the transportation process focused on high quality of transport servicing, and it can be reached active application of intermodal transportations. Thus, complexes of servicing of highly effective technologies on railway transportation are united in system of firm transport servicing (in Russian SFTO), based on high degree of use of IT technologies. Thanks to the kept uniform information field, good opportunities for close interaction of railways of Russia with railways of the states CIS and Baltics open.

Effective functioning of a railway transportation of the Russian Federation plays an exclusive role in creation of conditions for modernisation, transition to an innovative way of development and steady growth of national economy, promotes creation of conditions for Russia integration in world economic system. It is reflected in Strategy of developing of a railway transportation of the Russian Federation until year 2030.

The Russian railways are the second largest transport system of the world, yielding on total length of operational roads only to the USA. On extent of the electrified railways, the Russian railways take the first place in the world. The Russian Federation performs now more than 20 percent of a cargo turnover, and 10 percent of a passenger turnover of all railways in the world.

On the geographical position the Russian railways are an integral part of the Euroasian railway system, they are directly connected with railway systems of Europe and East Asia. Besides, through sea ports interaction with transport systems of the North America can be performed.

Railways are organically integrated into uniform transport system of the Russian Federation. In interaction with other types of transport, they meet the needs of the population, economy and the states. Thus, the railway transportation is a leading element of transport system, its share in maintenance passenger and cargo transportation makes more than 40 percent from all transport of the country.

Realisation of measures on reforming of the Russian railways has been begun by the Government of the Russian Federation in 1998.

However, despite successes of structural reform of a railway transport in Russian Federation, its actions and results have appeared are insufficient that in short terms to create effective sources of the developing, allowing to provide scale attraction of means in developing of branch and its modernisation, to generate conditions for its long-term steady growth and competitiveness increase in the world market.

The analysis of the problems which have arisen in sphere of a railway transportation, has allowed to reveal the following key moments which are critical for the further social and economic growth of the country:

- Necessity of the accelerated renovation of a fixed capital of a railway transportation;
- Overcoming of technical and technological retention of Russia from the advanced countries of the world on level of railway technology. For example, in Russia there does not exist highspeed trains still;
- Necessity of decrease in territorial disproportions for developing of an infrastructure of a railway transportation, improvement of transport security of regions and developing of admission rates of railroad lines;
- Necessity of removal of restrictions for growth of volumes of transit cargo transportation;
- Necessity of increase of safety of functioning of a railway transportation; and
- Insufficiency of investment resources.

It is necessary during the period reaching year 2030 to realise “Strategy of developing of a railways in the Russian Federation till 2030”. At the heart of Strategy following principles lie:

- The railway transportation is one of bases of political, social, economic and cultural unity of Russia;
- The railway transportation is the important component of maintenance of high level of defensibility and safety of the state;
- Effectively functioning railway transportation is an obligatory element of maintenance of competitiveness of the country;
- On a railway transportation the effective combination of state regulation and self-regulation market mechanisms is provided;
- Advancing developing and railroad system modernisation are an infrastructural basis of social and economic growth of Russia; and

- Increase of level of safety of functioning of railway transportation is the major state priority of developing and modernisation of transport, scientific researches and current operational work.

The Strategy purpose is making up of conditions for steady social and economic developing of Russia, increase the mobility of the population and cargoflows optimisation, strengthening of the economic sovereignty, national safety and defensibility of the country, decrease in cumulative transportation costs of economy, increase of competitiveness of national economy and maintenance the lead positions of Russia on the basis of advancing and innovative developing of the railway transportation harmoniously co-ordinated to developing of other branches of economy, types of transport and country regions.

Strategy is directed on the decision of following commitments:

- Realisation of transit potential of Russia on the basis of integration of a railway transportation into the international transport systems;
- Decrease in cumulative transportation costs, including at the expense of increasing efficiency of functioning of a railway transportation; and
- Maintenance of the right of citizens of Russia on favorable environment.

On the basis of an estimation of prospects of developing of the Russian economy and taking into account developing of other types of transport the basic volumes of railway transportation - loading of cargoes and cargo turnover are predicted.

By the minimum variant loading of cargoes in 2030 is predicted in volume of 1970 million tons with growth (to level of base 2007) in 1.47 times.

The cargo turnover is predicted in volume of 3050 billion in tonne-km with growth (to level of base 2007) in 1.46 times.

By the maximum variant loading by 2030 will increase in 1.6 times and will reach 2150 million tons.

The cargo turnover in 2030 will increase in comparison with 2007 in 1.58 times and will make 3300 billion in tonne-km.

If we will look at geography of transportations we can see that it is highly concentrated in several regions. So, in these regions transportation will have multiplifier factor higher that predicted in the Strategy. This means congestions on roads and problems with fluent cargoflows. Developing contrailer (combined) transportations providing a combination of advantages of railway and motor transport can become a long-range direction of increase of competitiveness of railways of Russia.

2. Literature Review on Contrailer Research

At the moment it has been spent large amounts of funding and time in abroad on these subjects, concerning intermodality of road-rail-seaports. Woxenius (1998) has analysed the international experience of the use of intermodal transportations. Various concepts of accomplishing of loading technics on intermodal transport terminals are considered. He has qute interesting scheme, where is shown main gateways between national/regional network modules in future EU intermodal transportation system.

In Russia a lot of works (Kotljarenko, Kozlov, Kirpa, Dyomin, Kogan, Salatov, Shobanov) are devoted to the research of various aspects of the contrailer organisation, etc.

Kotljarenko researches efficiency questions of contrailer transportations. At the same time key persons of railways abroad and many experts of railways in Russia continue to consider that the combined transportations will not justify the efforts spent for their organisation, as the mid-annual income counting on each maintained rail car at the combined transportations much more low, than at other kinds of transportations. This fact complicates a competition to automobile transport and speaks that at the combined transportations on platforms is transported only one automobile trailer or the container whereas at other kinds of transportations all rail cars, as a rule, are loaded to the maximum capability that as marks Baritko, does not do effective contrailer transportation. However researches of All-Russian Railway Research Institute confirm that contrailer transportations – essentially new type of service of a railway transportation which confidently type rates of the developing abroad in the CIS countries, especially at a transit transportation and delivery of the foreign trade cargoes.

Kozlov researches questions of creation of the automated terminals for the organisation container and contrailer transportations. Questions on a choice of a complex of means of mechanisation and automation of processes of processing contrailers are researched.

Kirp’s, Dyomin's researches the answer about possible ways of developing of the combined shippings goods to Ukraine is given, the basic problems transshipment and the combined transportations are formulated.

Salatov’s and Shobanov's work theoretical aspects of an estimation of economic efficiency contrailer transportations are researched. The economic-mathematical model of calculation of economic efficiency is considered.

Shobanov researches is devoted bases of a complex estimation of economic efficiency contrailer shippings goods in the international communications, the economic-mathematical

model is specified, its components are considered, the algorithm of calculation of economic efficiency contrailer transportations is developed.

Dyomin's researches efficiency spheres contrailer transportations in Ukraine are specified, placing and brace questions contrailers on an open rolling stock are considered.

Snigur (2006) develops algorithms of optimisation of contrailer trains at various variants of their making up and sorting.

We can admit that in Russia only few researches are oriented on real projects. They are more like philosophy-oriented without calculations of total costs and enviorement influence.

3. Experience Analysis on Contrailer Transportation

Both Europe and Russia choke with quantity of supersize vehicles on the highways literally. This situation is negatively reflected in ecology, a condition status of a roads and breakdown susceptibility. From the end of a century, before last among engineers of the different countries, the idea to put the car on rails that would remove the majority of the named problems soars. However, consolidating of indisputable pluses contrailer transportations with commercial benefit from a similar way of transportation of cargoes remains, while an unresolved commitment.

In Russia the proper attention is not given to contrailer transportations. And, in spite of the fact that for today there are structures which possess technical possibilities and technological developments for realisation contrailer transportations (first of all, these are the large forwarding organisations), these transportations do not develop. As a result available potential of railways on granting remains to clients of additional services and advantages not claimed. Thus, potential incomes which at this conjuncture leave on competing types of transport are lost. As to the relation of the state to problem, contrailer transportations until now, it have had purely declarative character.

The given kind of transportations is new to the republics of the former USSR. In Europe they have already experience almost of three decades with successful use of contrailers. To them, on a general recognition, the surveillance, protection and safety of route, simplification of customs procedures, decrease in alert conditions on roads, the decision sharp of questions of turns on borders concern a rigid schedule of availability of cargo to the receiver. In the European countries transportation in contrailer trains is the integral component of overall logistics chain deliveries.

Conversations on necessity of developing contrailer transportations in Russia were conducted during 50-60’s of the last century. However, all practical experience of similar transportations keeps within only in some indicative demonstration trips. For the first time on a substantial scale to perform contrailer transportations in Russia, Abakan wagon factory about hundred specialised platforms, has been made in the early 1990’s. It was planned that they will be maintained on a route of Helsinki–Moscow. Involved departments have developed tariffs, considering the size of expenses by transportation motor transport, and have tried, that the railway component in the aggregate the size of the rate did not exceed 32 %. But the rail cars intended for transportation, have been executed as poor. As a result the bottom parts of trucks at transportation have been damaged. During demonstration trip from Moscow to Poland there was a similar incident – when unloaded from platforms trucks also have suffered. When trial trip from Moscow to Novorossisk was performed, tens of trail cars were damaged, that they properly were not fixed on platforms. After these unsuccessful experiments, the railways began to work over creation of the new specialised rail car. The Torzhoksky wagons factory was engaged in the given commitment. The rolling stock design was not ideal too – it has appeared what to ship trucks on platforms was possible only by means of the elevating crane, preliminary having unhooked tractors. Probably, this model also would be finished, that is the new variant of arrival on a platform from the earth is thought up, only market conditions have changed and idea of contrailer transportations have for a while left alone.

The second stage of developing contrailer transportations mostly concerns the post-Soviet territory, rather than to Russia. In 2003 the Ukrainian railways together with railways of Belarus and Lithuania, realised the project of a train of the combined transport "Viking" plying on a route Ilyichevsk (Odessa) – Klaipeda. Under the arrangement of all participants of the project rail cars have been included in it with universal and refrigerator containers, road trains, demountable bodies. For journey and a food of drivers passenger compartment car and a dining-car have been provided. "Viking" – the joint project of the Lithuanian, Belarus and Ukrainian railways, the stevedore companies of the Klaipeda, Odessa and Ilichevsky ports.

The train has been intended for transportation of 20 and 40 foot containers, semitrailer trucks, and road trains (contrailers), arrived by the sea in the Klaipeda port from Scandinavia, other countries of Western Europe and further the following to Belarus, Ukraine or through the Odessa and Ilichevsky ports to the East and Caucasus or in the opposite direction. The train "VIKING" - has connected two ports – Ilyichevsk on Black sea and Klaipeda on Baltic

sea, and also two capitals: Kiev (Ukraine) and Vilnius (Lithuania). According to the intergovernmental arrangement between Ukraine and Lithuania, since 6th of February 2003 there has begun regular traffic of a train of the combined transport under the title "VIKING". The train follows under №1161 on a route Ilyichevsk – Kiev – Klaipeda and under №1162 in the opposite direction. The general distance of a route is 1733 km. The train is in a road 56 hours and 30 minutes. Transportation cost joins registration transportation documents, transportation of one trucking facilities on a specialised flat, journey of the driver in the carriage, passage of customs registration to Ukraine, Belarus and Lithuania, protection of trucking facilities throughout all transit. A food of drivers is performed in a dining-car at own expense, under reasonable prices. For all the time as a part of the given train 539 contrailers have been transported. Since 2007 for some reasons their transportation has stopped.

In 2003 in Ukraine "Yaroslav" developed, together with the Polish railway, contrailer train usage. It operated on a route of Kiev to Slavkuv under №1163/1164. The general extent of a route was 1028 km. Following of a train taking into account crossing of the Ukrainian and Polish borders occupied — 38 hours 41 minutes. After unloading of rail cars in Slavkuv the further transportation of cargoes was performed by motor transport. The train "Yaroslav" has given the chance to autocarriers to pass deep into Poland on 404 km by rail, while the automobile communication of tractors on territory of this state on weekends was terminated. In 2004 the train route has been prolonged to Lugansk. During years 2003 – 2004 and 2 months of 2005 as a part of a train in both directions, it has been transported 3.2 thousand contrailers. However since February, 2005 and this train has stopped the existence.

In the summer 2007 contrailer transportations in Kazakhstan have started. From the South Kazakhstan to capital region - Astana contrailer platforms with automobile trucks were sent, loaded with Uzbekistan and the South Kazakhstan vegetables and fruits. Contrailer technologies as has underlined Abdimaulen Tukibaev, the chief of Shikmentsky branch of JSC "Kazzheldortrans", will allow to raise quality of servicing of cargo owners at the expense of reducing of a time of delivery of cargoes “from a door to a door”, decrease in time for transportation of fruit-and-vegetable production as a whole. Contrailer platforms are convenient, as loading-unloading occupies a maximum an hour and a half. The vehicle with cargo at station loads on a platform, where it was fixed. When the platform arrives on a place, all occurs to be upside-down.

With the help of contrailer transportations in republic experts expect to solve a problem of deterioration of road coverings. Instead of carrying out of mass repair road works

administration of the republic try to “change minds” of motor transportation branch by means of popularisation contrailer transportations with the lowered tariffing.

In Russia developing of the combined transportations will allow to free from road transport and keep highways in the usage of passenger cars; this considerably improves environment ecology, will increase the reliability and safety of delivery of cargoes, and will yield for the economy its needed resources. One more of factors of perspectivity of developing contrailer transportation is following: Possible in this case reducing park of covered rail cars as a considerable flow of cargo of small shipments transported on the long distances, it will be possible to deliver in contrailers. It, of course, will demand increase in park of platforms for transportation contrailers, but their manufacturing is cheaper, and platforms are more universal rolling stock, than covered rail cars.

Interest to contrailer to transportations for consignors is explained by obvious benefits: increase in commercial speed of a shipping goods, increase of safety of cargoes, transportation depreciation. For autocarriers contrailer transportations mean also simplification of loading work, reduction of park of tractors, reducing of an idle time of road trains on border points, decrease in deterioration of an automobile rolling stock, reduction of expenses by repair, acceleration of delivery of cargoes «from a door to a door», decrease in number of accidents of motor transport, alleviating of an operating mode of drivers.

The state also can be interested in developing contrailer transportations. They provide the decrease in loading of a road infrastructure, especially on directions with a high density of traffic of supersize road trains. Other factor of introduction contrailer transportations is reduction of influence by environment of harmful emissions of motor transport. Developing intermodal auto-railway contrailer transportations will have great value for economy of the Russia. It will allow it to be entered in world system of export-import deliveries of the goods and services more full. Intermodal transportations possess high potential in the field of transportation, and their value will increase at achievement of sufficient level of profitability and quality. Besides, the organisation of the given kind of transportations will allow to load into Russia in regular intervals a transport infrastructure of the country that will provide increase of efficiency of its work and the fullest conformity to high requirements of consumers of transport services, will give the chance to react to market condition fluctuation flexibly.

Experience of foreign countries proves economic efficiency of contrailer transportations. On railways of the USA the fast rates of transportations of contrailers, automobile semitrailer trucks, on a specialised rolling stock have been developed. Volume growth of contrailer transportations on a railway transportation of the USA in the conditions of prices for a diesel fuel rise and increase of competitiveness of railways in relation to the motor transportation companies is caused by a number of the reasons among which the cores are: Switching of a considerable part of a goods traffic from covered rail cars to automobile semitrailer trucks, the organisation of transportations of automobile semitrailer trucks by specialised routeing trains, which follow on constant routes under the fixed schedule, concentration of reloading operations on rather small number of large terminals with high level of mechanisation, perfection of transport servicing at transportations in mixed railway-automobile communication. In the USA at the initiative of the government still in 50's, the concept of developing of the combined transportations in which basis the idea of the organisation of high-speed delivery cargoes in containers and semitrailer trucks by routeing trains between contrailer-container points on all network of roads of the country has been developed. Now all cargoes on distances to 800 km here are transported, as a rule, in a direct automobile communication, and further 800 km – in mixed railway-automobile. For the last two decades the large material base for realisation of the combined transportations is created. In a motor pool is more than 2.7 million semitrailer trucks, about 600 thousand trail cars and 1.3 million autotractors. The railway transportation has more than 300 thousand specialised platforms for contrailer transportation.

In the country more than 100 complex contrailer terminals of national value, more than 500 basic terminals on all types of transport and some thousand sorting points are crossed. For initiating of system of the combined transportations a number of privileges and the privileges of financial and legal character stimulating developing of these transportations and transfer of volumes from motor transport on the railway has been given the railway companies of the USA.

The current state of contrailer transportations is abroad characterised by their considerable growth, both in Europe, and in the North America. Importance of developing of this kind of transportations admits the governments of the majority of the European countries, the USA and Canada for economic and ecological reasons. On developing of an intermodal transport large recourses were allocated as follows are designated: 70 % - on standardization of a

railway track, 11-16 % - on a carriage rolling stock, 5-6 % - on the reloading equipment and 10-13 % - on terminals.

Especially fast rates an intermodal transport internationally, as result of growing integration in Europe develops. The international transportations make over 50 % in a cargo turnover of an intermodal transport. The combined transportations on the European continent have got the special importance thanks to prohibition of cargo transportation on highways in ecologically protected zones.

4. Main Types of Contrailer Transportation

Now abroad there are some systems contrailer transportations, which on a way and a way of loading on a railway vehicle can be divided line hauls into following kinds conditionally:

1) *"hukkepak"* - transportation on platforms with horizontal or vertical contrailer loading, equipped wheels in diameter of 950 mm or the reduced diameter, having the normal either lowered level coupling system or united in a train with "a continuous" false deck. Such kind of transportations was widely adopted in countries of Western Europe.

2) *"roadtrailer"* transportations concern them:

- Special semitrailer trucks on combined auto-railway to a course
- The modernised semitrailer trucks with special railway bogies

3) *"combined"* – when the strengthened or routine semitrailer truck is established by a back part on one railway with the reduced diameter of a wheel.

Roadtrailer and the combined ways of transportation are extended in the countries of the North America.

From the technical point of view there are no standard documents regulating transportation contrailers on territory of the Russian Federation. At road train installation in the rail car, its transportation should be performed with special load; accordingly for the organisation of this kind of transportation development of special documentation is required. By transportation in the Russian-Finnish through railway service, it is required to be guided by regulations and the securings of loads, transported in the Russian-Finnish through railway service.

Standard specifications on placing and brace of trailers and road trains in rail cars by transportation in the Russian-Finnish through railway service consist in the following:

- Cargoes in contrailers should be placed and fixed according to requirements to placing and a securing of loads in large-capacity containers.
- Before loading contrailers on a platform the consignor is obliged to prepare cargo for transportation so that traffic safety of trains, safety of transported cargo was provided. Canvas sheaths of the contrailer should be in a satisfactory condition status, not have the damages provoking access to cargo. Loops and apertures in a canvas sheath, a cable for denim brace, and also a loop on a body should be roadworthy and not have damages. The fixing cable should be whole, without merging traces. Cables fixing a shade-shed should be reliably packed and not have breakages and connecting knots, and the ends of the basic fixing cable should be connected in reliable knot.
- Places for wheels clear of snow, ice and dust.
- Transportation is performed as special load. An index of oversizing is “H-0030”. This means that contrailer is going out from loading gauge at 3rd level.
- The Design of a platform for transportation of trailers and an equipment arrangement should provide safety of the processors, and also convenient access at survey, maintenance service and repair.
- Autotractors should not have normal functioning oil and fuel systems.
- Transportation on specialised platforms of contrailers with defective brake system is not supposed.
- Car glasses should be terminated with special boards which should be available for the driver, for the purpose of protection against casual hits of extraneous subjects.

Loading and unloading of trailers should be performed on the special platforms equipped with access roads with load-lifting devices of demanded capability, providing safety of a trailer and transported cargo.

As a whole all over the world combined contrailer transportations are considered as natural process of overcoming of competitive relations between automobile both by rail and transition to cooperation relations. This process becomes possible only with state support of contrailer transportations as principle of protection of environment and ecological protection of citizens, and also as method of maintenance of the equilibrium competitive environment in sphere of cargo transportation of cargoes, first of all, in international, and also in domestic transportation.

Volumes of contrailer transportations increase on the average by 10 % a year. At the expense of system perfection operational expenses decrease and if to consider that except a share of road transportation cargoes, it is possible to involve in additional parts of cargoes, which are transported with an intermediate overload from motor vans in covered rail cars, becomes the organisation of system obvious necessity of contrailer transportations in Russia.

5. Analysis of Organization of Contrailer Traffic in Russian-Finnish Transportation

Under EU financed Lognet project with participation of JSC RZD specialists' question of contrailer transportation between Russia and Finland has appeared. The bases for this purpose were:

- Incessant growth of transportations on the given direction, limited to admission rate of automobile boundary transitions;
- Constant multikilometer queues on automobile boundary transitions, deteriorating of ecological conditions on Karelia, extreme deterioration of a road covering of a federal line Moscow – St.-Petersburg – Vyborg – state border;
- Predicted by Federal customs service and the Ministry of economic development and trade falling of volumes of carriages by rail between Russia and Finland by 2011;
- The necessity of realisation of new business projects for JSC RZD connected with it; and
- Interest of the Finnish party in realisation of the given project.

Proceeding from the above-stated, the project purpose – determining of possibility of creation of effective business on transportation contrailer cargoes in the Russian-finnish transportation.

Project commitments:

- Calculation of the business plan with determining of participants, risks, efficiency of the project;
- Preparation of references in public authorities on creation of optimum conditions for project realisation;

- Creation of joint venture with the Finnish railways VR Ltd, the Russian logistic companies;
- Increase of competitiveness of transportation by rail;
- Increase in profit of JSC RZD from realisation of the international cargo transportation.

At the first stage of the work the group has analysed cargo turnover structure in Russian-Finnish the transportation.

In 2007 considerable growth of an automobile through transportation through Finland to Russia has proceeded. According to Customs office of Finland volumes of an automobile cargo transportation have grown on 25 % in comparison with 2006. Thus, the total of the trucks, which have crossed the Russian-Finnish border in both directions, has exceeded for the first time 1 million units.

1. Structure of the market of motor movements between Russia and Finland:

- By rolling stock kinds:
  - 29 % - containers on cars;
  - 24 % - automobile transporters;
  - 47 % - cars with small shipments.
- On delivery region:
  - 70 % - Moscow and Moscow Region;
  - 25 % - St.-Petersburg and Leningrad region;
  - 5 % - other regions.
- On an accessory forwarders:
  - 90 % - Russian грузоперевозчики;
  - 10 % - other carriers.

Proceeding from the received information, it was found out that the basic object for contrailer transportations is the car with small shipment in direction from Finland to Moscow.

It has considered three possible variants of the organisation of the contrailers.

1. Route train with the co-ordinated length on a shoulder «St.-Petersburg – Kouvola».

Advantages:

- A short distance; and
- Arranging traffic possibility under the rigid schedule.

Lacks:

- Necessity of building of the separate terminal in the Russian territory;

- High probability of empty run of a specialised rolling stock; and
- Discrepancy to the basic direction of freight traffic.

2. Single rail cars in ordinary train transportation.

   Advantages:

   - The minimum time of accumulating.

   Disadvantages:

   - Following with routine cargo speed (out of the accelerated trains); and
   - Low level of safety of cargo (it is impossible to provide qualitative protection on the route).

3. Inclusion of rail cars with contrailers in the accelerated container train "Polar Lights" plying on a route Kouvola (Finland) – Moscow-tov.-Okt. (Russia).

   Advantages:

   - High speed of a cargo delivering;
   - Transportation on a demanded shoulder;
   - Presence of the developed terminalno-warehouse infrastructure;
   - High safety of cargo; and
   - Reducing of time of accumulating kontejnerno-kontrejlernogo trains.

   Disadvantages:

   - Insignificant loss of time under accumulating.

On the basis of the spent analysis the most actual shoulder contrailer trains or single contrailer platforms with the subsequent inclusion in a container train on a route Kouvola–Moscow has been established.

Next the analysis of potential clients and possible volumes of their transportation have done:

- DHL Freight – 10-15 contrailers in a week;
- Schenker – 10-15 contrailers in a week;
- DSV – 5-6 contrailers in a week;
- Transpoint International – 10-20 contrailers in a week;
- Bewesip – 20-25 contrailers in a week;
- Varova – 5-10 contrailers in a week;

Total – 60-91 contrailers per week.

Next stage of work has been devoted to studying of questions of pricing.

The through rate for contrailer transportations on a route Kouovla (Finland) – Moscow (Russia):

- Trailer loading on railway platform in port of Finland – 1.5 thousand roubles;
- Railway tariff across Finland (taking into account return) – 18.5 thousand roubles;
- Railway tariff across Russia (taking into account return and guarding) – 71 thousand roubles;
- Removal of a loaded trailer from railway platforms in Moscow – 1.5 thousand roubles;
- Cargo transportation in Moscow to a warehouse of the receiver (cargo customs clearance on railway terminal) – average 7.5 thousand roubles;
- Loading of an empty trailer on railway platform in Moscow – 1.5 thousand roubles;
- Services of the customs broker in official registration of papers on contrailer transportation in Finland and Russia – 0.7 thousand roubles; and
- Trailer leasing – 35 thousand rbl.

Total – 138.2 thousand rbl.

The through rate on a motor movement on a route operating between Kotka (Finland) and Moscow (Russia) taking into account protection, insurance, cargo declaring on boundary transition and empty return of the car makes 75 thousand rbl.

At the next stage SWOT-analysis has been made, which is shown in Table 1.

Table 1. SWOT analysis of discussed new option for railway transport.

Strength	**Weaknesses**
• Trade turnover Growth between Russia and Finland • Interest of federal and regional authorities of the Russian Federation and Finland • Reducing of an idle time of road transportation in turns on boundary of automobile transitions (from several days to hours) • Reduction of the expense of automobile fuel • Considerable decrease in environmental contamination • Maintenance of safety of highways • Decrease in probability of road and transport accidents	• Not Competitive tariff rate on transportation • Absence of customs conditions for the organisation of transportations • Features of schemes customs clearance of cargoes • Developing of the Russian ports • Document circulation • Complication on transportation
Opportunities	**Threats**

• Presence of is standard-legal base with the Finnish railways
• High level of partner relations with the Finnish railways
• The Skilled personnel of JSC RZD
	• Absence of the certificated rolling stock
	• Absence of a terminal-warehouse infrastructure
	• Low, for today, delivering cargo time (on an example Port Kotka – Moscow):
	  • A car of 3 days (including queue at the border)
	  • Railways 5-6 days.
	• Absence of a monostream of cargoes

6. Conclusions

Obviously, the capital is not the consumer of all volume of accepted cargo. So, powerful stream on the given direction is caused by the developed terminal-warehouse infrastructure of Moscow and Moscow suburbs and the turned out "grey" customs schemes.

Recognising that increase in distance of transportation liquidates a difference in its cost between railway and motor transport, and in view of numerous logistics projects in regions (Nizhniy Novgorod, Samara, Rostov-on-Don, Ekaterinburg, and Novosibirsk) and gradual transition of work of customs, we have come to the following conclusion: Despite numerous pluses, in modern Russian conditions realisation of the given project, without the support of bodies of the federal and regional power (economically and technically), it is not interesting for business.

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Strategy of developing of a railway transportation of the Russian Federation till 2030.

Factors affecting the profits of LSPs

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Abstract
This study examines how negotiation power, image of the industry and contracts affect the profits of logistics service providers (LSPs). The empirical data was gathered from Finnish LSPs in 2008. The survey resulted in 460 acceptable responses, representing a response rate of 17.7 %. The model was tested with structural equation modeling (SEM). The results revealed that a weak negotiation power of LSPs decreases their profits. However, a positive image of the industry seems to facilitate profitability. In addition, contracts seem to facilitate profitability of the LSPs, but only if those are accurate and updated. As a conclusion, in addition to negotiation power and contracts, the image of the industry is found to be important as well when logistics service providers want to increase their profits. Thus, from a managerial point of view logistics service providers should consider positive image of the industry if they want to increase their profitability.

Keywords: LSP profitability, Negotiation power, Contracts, Image of the industry, Structural equation modeling

1. Introduction

In Finland, the deregulation of transportation business in the beginning of the 1990s made it possible for anybody to establish his or her own transportation company. Consequently, a large number of new transport companies were created. In addition, other companies noticed an opportunity to enhance their business by outsourcing their transportation functions to these newborn companies. Despite this development, the sizes of these transportation companies remained quite small (see,e.g. Nickerson and Silverman (2003) who studied the reasons why all truck drivers do not own their trucks), the competition turned out to be very harsh towards the end of the decade, and multiple bankruptcies among small logistics companies took place. Ever since, the profit margins have remained very low and every time the price of fuel rises in Finland or other costs go up, transport companies face severe problems because of the rising costs. This may cause a lack of transport services in the future, if many companies leave the marketplace at the same time when large age groups reach their state pension age. Therefore, it is necessary to find out how the entrepreneurs of these small transportation companies might improve their profits.

This paper aims to reflect this need by examining how negotiation power, image of the industry and contracts affect profits of logistics service providers (LSP). The theoretical background of the paper is rooted in agent theory and game theories in order to identify how contracts and negotiation power affect profits. In addition, the study widens these traditional

perspectives by taking the image if the industry into account and considering it as a factor which may affect profits. Although usually all the explanatory variables are considered to be included within negotiation power, in this paper contracts and the image of the business are excluded from it. The reason for distinguishing contracts from negotiation power is that contracts have a different time dimension in relation to negotiation power as contracts extend current negotiation power to the future. In addition, in the empirical part of the study, entrepreneurs were asked questions about their opinions regarding the transportation industry and this gives us a great opportunity to study to what extent their personal opinions may influence negotiations with the transportation industry.

A tentative model was developed on the basis of the conceptual overview, and it was consequently tested with empirical data. The empirical data was gathered from the LSP members of the Finnish Transport and Logistics (SKAL) association in 2008. The survey was sent to all the 2604 transportation companies which belong to the association. In total, 460 acceptable responses were returned, representing a response rate of 17.7 %. According to the results, negotiation power has a negative influence on the profits of entrepreneurs. In that light, it could be argued that logistics entrepreneurs can be considered as “shippers´ slaves” in Finland. However, the positive image of transportation industry and updated contracts increase the profitability of logistics entrepreneurs. Especially, the discovery that LSPs’ attitude towards the image of the business influences their profitability offers a brand new and interesting approach to the question. In negotiations, the results are also influenced by the parties’ attitudes and they are not based only on negotiation power.

2. Theoretical Background

Since the aim of this paper is to examine how image of the industry, negotiation power and contracts affect profits of logistics service providers (LSP), each subject is discussed in more detail.

Image of the industry

It has been suggested that a company which can create a distinct image and stand apart from its competitors may be differentiated within its competitive environment (Balmer & Gray 1999). This is a widely studied phenomenon in the academic context, and has been called by

several names during recent decades - for example, corporate image formation, corporate identity management, and corporate reputation management. Nowadays this phenomenon is often called corporate branding. Corporate branding can be defined as *"a systematically planned and implemented process of creating and maintaining a favourable image and consequently a favourable reputation for the company as a whole by sending signals to all stakeholders and by managing behaviour, communication, and symbolism"* (Einwiller & Will, 2002, 101).

Accordingly, from the corporate branding perspective, an image consists of the attributes and benefits associated with a brand that make the brand distinctive and thereby distinguish the firm's offer from competition in a way that may provide a differential advantage (Webster & Keller 2004). Corporate image can be considered as views of the organisation developed by its stakeholders; the outside world's overall impression of the company including the views of customers, shareholders, the media, the general public, and so on (Hatch & Schultz 2003). In addition, some researchers have utilised this information by studying image from the internal perspective of a company, i.e. revealing employees or managers' image of the company.

This study takes these corporate branding discussions as a starting point and widens these by examining *the image of the industry,* i.e. the image of the transportation industry. Here it is assumed that a positive image of the industry may yield a competitive advantage. The image is studied from the perspective of entrepreneurs who operate within the transportation industry.

Negotiation power

According to Nash (1951), non-cooperative games also have an optimal solution based on the negotiation power of each of the parties involved. This means that when the parties negotiate, negotiation power implies how extra profits will be shared in a relationship. Negotiation power can result from market situation, relationship-specific assets etc. Mathematical form of the Nash's negotiation model could be, for example:

(1) $N = (-Y(r,V,P) - (-V))^{1-\theta} \cdot (Y(r,V,P) - P)^{\theta}$,

where N = Nash negotiation model

P = Alternative income to carrier if negotiations fail,

V = Value of the contract to the shipper,

r = Carrier's share of the profits, $0 \le r \le 1$,

θ = Carrier's negotiation power, $0 \le \theta \le 1$,

$1-\theta$ = Shipper's negotiation power,

$Y = P + r(V - P)$,

Y = Price if negotiations succeed.

The best result for the shipper is when his/her costs are the same as the alternative income of the carrier if negotiations fail (r = 0). Obviously the best result for the carrier is to gain price V (r = 1). When solving all the influences of the each factor to profit shares, we get that:

(2) $\frac{\partial N}{\partial r} = (1-\theta)(-Y+V)^{-\theta}(Y-P)^{\theta}(-\frac{\partial Y}{\partial r}) + \theta(-Y+V)^{1-\theta}(Y-P)^{\theta-1}(\frac{\partial Y}{\partial r})$,

And because all the profits will be shared between a carrier and a shipper,

(3) $\frac{\partial N}{\partial r} = 0$.

Thus,

(4) $(1-\theta)(-Y+V)^{-\theta}(Y-P)^{\theta}(-\frac{\partial Y}{\partial r}) = (-1)\theta(-Y+V)^{1-\theta}(Y-P)^{\theta-1}(\frac{\partial Y}{\partial r})$,

(5) $(1-\theta)(-\frac{\partial Y}{\partial r}) = \theta(-Y+V)(Y-P)^{-1}(-\frac{\partial Y}{\partial r})$,

(6) $1-\theta = \theta(\frac{-Y+V}{Y-P})$,

(7) $1 = \theta(\frac{-Y+V}{Y-P}) + \theta$.

(8) $1 = \theta(\frac{V-P}{Y-P})$,

(9) $Y - P = \theta(V - P)$.

By including the formula of Y to previous, the result will be that

(10) $P + r(V-P) - P = \theta(V-P)$,

(11) $r(V-P) = \theta(V-P) \quad => \quad r = \theta$.

Hence, profit share will be equal to negotiation power.

Contracts

Contracts are the most common way to reach an agreement on the price of services. Unfortunately negotiations to create a contract often are not without their problems. The contractual dilemma (Williamson 1971), which forces the parties to update their contracts, is a potential problem where the divergent interests between an agent and a principal will predictably lead to individually opportunistic behavior and joint losses. In addition, according to Tirole, (1999), numerous contracts are vague or silent on a number of key issues and can give room to opportunistic behavior. Thus contracts are an important tool to reach an agreement on how to share profits, but contracts have to be updated on a regular basis to be efficient.

Based on the conceptual overview, a tentative model was developed to describe how brand image (Hypotheses 1), negotiation power (Hypotheses 2) and contracts (Hypotheses 3) influence profits (Figure 1). As usual, negotiation power is expected to have a positive effect on profits (H2). Here, contracts have been separated from negotiation power, because contracts themselves are results of negotiation power if contracts are empowered and adequately updated. Contracts are expected to have a positive influence on profit sharing (H3). Image of the industry is a new phenomenon in this kind of study, and therefore it is expected that an opinion of one of the parties will not affect significantly profit sharing between parties (H1).

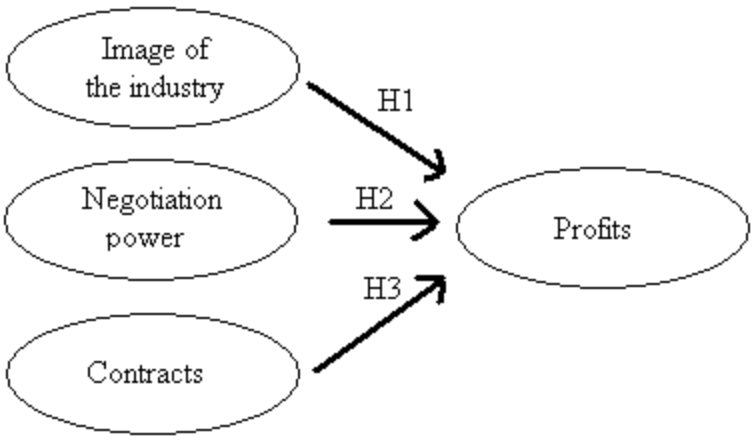

Figure 1. A tentative model

The concepts in the model can be seen as latent variables (or factors) that are not directly observable but are inferred from the other measurable variables. In practice, the operational measures were presented in a questionnaire as attitudinal statements based on the 7-point Likert scale (strongly agree … strongly disagree). Questions concerning contracts were answered by 'yes' or 'no'. The latent variables, their descriptions and the operational measures of the concepts are presented in Table 1.

Table 1. Latent variables and their operational measures

Latent variable	Explanation and operational measures in the questionnaire	Label
Image of the industry	Refers to a image of the industry	IMAGE
	Compared to other branches, transport business is well known because of its high quality	quality
	Compared to other branches people highly respect transport business	comresp
	Transport business is highly respected	resp
Negotiation power	Refers to negotiation power with customers	POWER
	Because of tight competition, customers can dictate the fees to transports	command
	Transport entrepreneurs are ”farmhands” for the customers	slave
	Our expertises and impacts are not effecting to our results, cause customers are ”taking out” all extra profits from our branch	takeout
Contracts	Refers to the contract validity	CONTRACT
	Your company has a valid transport contract	conton
	Clauses regarding your transport contract are up to date	clausul
Profitability	Refers to the profitability of LSPs	PROFIT
	We can move the growing costs straight to transport fees .	movecost
	Profitability of our transport company is very good	goodprof

3. Empirical analysis

Data description and estimation method

The empirical data was gathered from the LSP members of the Finnish Transport and Logistics (SKAL) association in 2008. The Internet based Webropol online survey questionnaire was sent via email to the members, and they were asked to answer the questions. Later, a reminder was sent to the members who had not yet answered the questionnaire.

The questionnaire consisted of various sections designed to map outsourcing-related issues for logistics in Finland, as well as including sections on how negotiation power, image of the industry and contracts affect the profits of the logistics service provider (LSP). Also, components from agent theory and game theory were used to identify how the contracts and negotiation power affect profits.

A total of 2604 SKAL member transportation companies were included in the survey. 460 acceptable responses were returned, representing a response rate of 17.7 %. The estimation was made with the Lisrel software (Jöreskog et al. 2000; Jöreskog et al. 1993a). The estimates were calculated by using the ML (maximum likelihood) method based on covariance matrix. The normality of the variables was studied with Prelis 2 software (Jöreskog et al. 1993b).

Data analysis

The tentative model was tested by using the operational measures described above. The results are shown in Figure 2. In the model, the highest non-standardized factor loadings are set to be one so that the scale of the different factors remains the same.

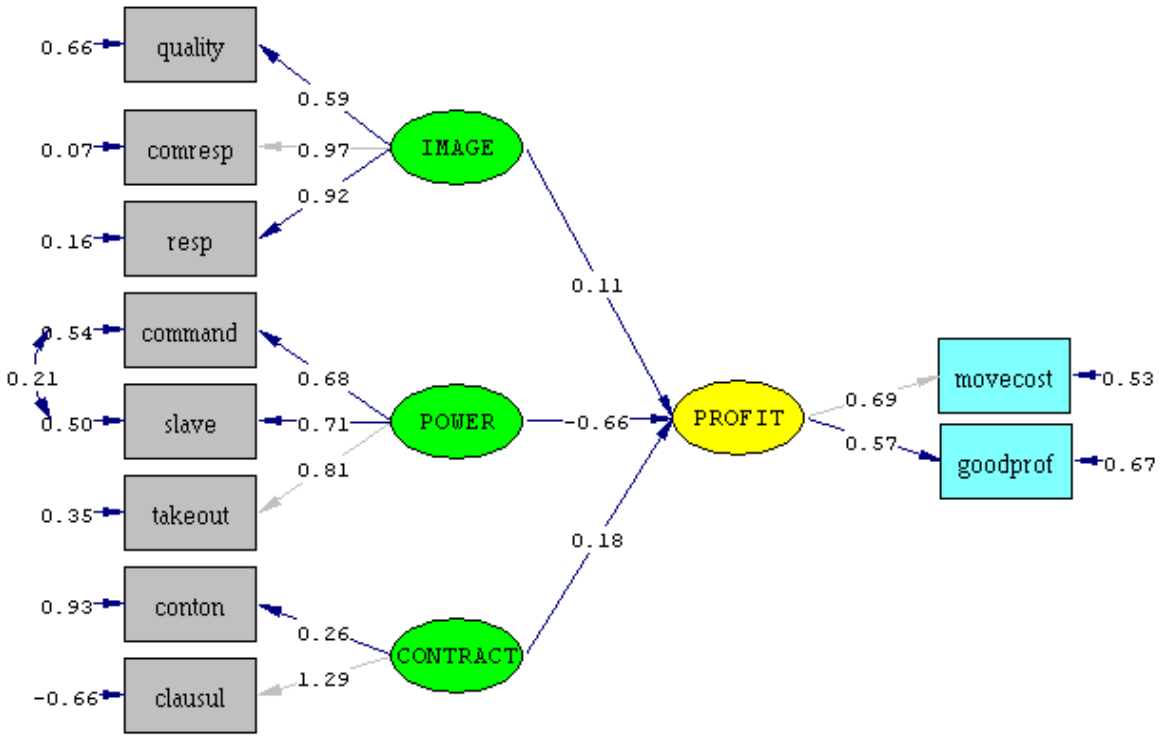

Figure 2. Empirical model

The model provides a very good statistical fit (see Table 2). All relationships in the final model are statistically significant. The factor loadings are good. Error correlation between measures *command* and *slave* has been set to be free based on LISREL's modification indices. This error correlation makes sense because obviously carriers feel that they are shippers' slaves if shippers can command the prices of the shipments. Measures of the factor *contract* shows low and high loadings based on their nature as dummy variables. The model shows that the influence of negotiation power and contracts was predicted by the research hypotheses two and three. The image of the industry was a real surprise. It shows positive relationships between LSP's attitude towards their business and profitability, unlike in the prediction of the tentative model.

Table 2. Fit indeces of the final model

Test	Value	P-value
chi-square (df)	31.54 (28)	0.294
RMSEA	0.017	
CFI	1.00	
GFI	0.99	
SRMR	0.030	
normed chi-square	1.126	

All relationships in the model are statistically significant. Thus, as there aren´t any insignificant relationships in the model, and based on the test values above, the model can be considered acceptable. Additionally, each latent variable was evaluated with their construct reliabilities and average variance was extracted (Table 3).

Table 3. CR's and AVE's

Latent variable	CR	AVE
IMAGE	0.87	0.68
POWER	0.78	0.62
CONTRACT	0.90	0.62
PROFIT	0.57	0.44

Some of the factors have only two measures, and therefore they are considered unidentified without a full structure and it is impossible to perform factor analyses of individual latent variables. This also weakens the usability of the traditional test values like construct reliabilities (CR) and average variance extracted (AVE) and, therefore, the results should be evaluated primarily on the basis of the fit indexes of the full model and theoretical background of these measures. Mainly, also the CR and AVE values support a good statistical fit of the model, whereas profits have low values. Acceptable statistical fit of the full model justifies including profits as a latent variable even though CR and AVE values are low.

4. Conclusions and further studies

The purpose of this study was to examine how negotiation power, image of the industry and contracts affect profits of the logistics service provider (LSP). In this paper the theoretical background was rooted in agent theory and game theories in order to identify how the contracts and negotiation power affect profits. In addition, the image of the industry was considered a factor which affects profits. Although usually all the explanatory variables are considered to be included within negotiation power, in this paper the entrepreneurs gave answers regarding both their own negotiation power and the image of the transportation industry. Contracts were distinguished from negotiation power because contracts have a different time dimension in relation to negotiation power, as contracts extend current negotiation power to the future. In addition, in the empirical part of the study, entrepreneurs

were asked questions about their opinions regarding the transportation industry and this gives us a great opportunity to study to what extent their personal opinions may influence negotiations with the transportation industry.

Based on the conceptual overview, a tentative model was developed and tested with empirical data gathered from LSP members of the Finnish Transport and Logistics (SKAL) association in 2008. The survey was sent to the entire target group consisting of 2604 transportation companies which belong to the association. 460 acceptable responses were returned, representing a response rate of 17.7 %.

The results of the research indicate that the negotiation power of Finnish transport companies is very unsatisfactory and thus affects negatively their capability to gain acceptable profits from the shipping markets. In addition, the image of the industry was also found to be an important factor for each actor in the business. Furthermore, the contracts by themselves seem to be almost futile unless there is an effective, built-in updating system within the contracts. With adequately updated contracts, logistics entrepreneurs may gain better profits even if their negotiation power is weak.

As a theoretical conclusion, an interesting finding is that the image of the industry may have an impact on the profits of the actors operating in that particular business. In addition, contracts differentiate negotiation power from profits, especially when the contracts are adequately updated. An interesting point was that the attitude of one party influences their profitability, even when usually in negotiation models all factors only have influence within negotiation power, and negotiation power is considered the only thing that influences profit sharing. As a managerial conclusion, it is crucial to the logistics entrepreneurs to have an effective updating system for their contracts if they want to improve their profitability. Non-updated contracts seem to be almost useless. It is also important to all the actors in the shipping business to improve the image of the transportations industry, because a good image seems to benefit them all.

The study raised several new questions and ideas for further studies. First, it is very important to continue the studies about how the attitude of one party can influence the profit sharing between the two parties. Second, transportation as well as logistics in general is a seldom – if at all – studied context from corporate branding perspective (Ahonen 2008). Therefore, logistics may offer new insights into the corporate branding studies as an empirical context and should therefore be studied in more detail. In addition, outsourcing seems to be an unknown concept among corporate branding studies. Therefore, studying outsourcing from corporate branding perspective may offer new ideas for theoretical developments in that field.

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Outsourcing of local passenger transportations

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Abstract
Problem of organization of local passenger traffic is in the main focus of this article. Experience of the author in Sochi 2014 project highlights interesting view on this issue. Choosing of railway transport for local passenger transportation, instead of automobile road construction, is a key point in this article.

Keywords: Passenger transportation, local passenger traffic, Russia

1. Importance of suburban civil passenger traffic by railways

During 2007 in the suburban report of Russia, it is accomplished that 650 million single and 3.5 million subscription tickets at 3829 stations and stopping points were sold. On October railroad during the summer schedule of 2008 local services were 591 suburban trains on the working days and 611 during weekends. The reconciled of these figures does not reflect sufficiency, quality of offered services and satisfaction of using them.

Lacks of a suburban complex of Russia concern: A low condition status of an engineering-transport infrastructure, and old technologies of the organisation of civil passenger traffic. The actual commitment in local services consists in elimination of "narrow" places in a network infrastructure of large knots of megacities and cities-millionaires and on approaches to them, in innovative developing, first of all a rolling stock, passenger stations and transfer points. The best way of the decision of commitments of modernisation of a suburban network is introduction of logistic methods of servicing of passengers.

2. Commitments of passenger logistics

The logistics does not manufacture, does not sell, and does not transport. It optimises expenses on the organisation of passenger streams “from a door to a door” (from a residence before work or other target point) during compressed time, “is exact in time”, safely, cheaply and comfortably. Three most important issues on passenger logistics are following: high quality of services for clients, efficiency of operations of transportation process, and reliability of partner relations of all participants of transportation.

The logistics represents competitive advantage of the passenger companies to the clients at the expense of innovative improvement of quality of servicing of consumers, the optimisation of expenses reducing the general costs not only the passenger, but also the

transport agency. An end result is the increase of efficiency of the company and its profits. For stage-by-stage optimisation of interaction of all participants of transportation process, including the passengers, all business – process of transportation of passengers is structured on logistic components within the limits of time, costs of services, ways and technologies of transportation operations and work of the processors.

One of working tools of innovative technologies in logistic business is outsourcing. It's developing in Russia, as well as logistics as a whole, lags behind rates of the Europe.

3. Conceptual preconditions of outsourcing in the passenger transportations

Outsourcing - multidimensional concept which reflects the world phenomenon caused by transfer of 95 % of the western companies of a part of the functions, more often not profile, but necessary for business, "on the party" - to professionals. Such transfer has developed historically on the basis of deep economic calculation. The concept is used as the wide term describing set of forms of co-operation. One of the European determinings of outsourcing assumes "transfer not only functions or divisions, but also the actives connected with them in the company of the service provider". Outsourcer represents the expert of the higher class in the concrete sphere, capable to increase value and return of the accepted actives. Quality of servicing from outside ousourcer is caused by the account of a spectrum of factors. A considerable role in an estimation ousourcer and its choice the reasons of the reference to outsourcing and cost play the factor (the price of offered services).

Conceptual preconditions of distribution of outsourcing are caused be fluctuations in commercial activity in the 21st century beginning: maintenance of its competitiveness by anyways became the basic problem of business, or traditionally independently to improve, or from zero to develop a new technique, including outage ways (outsourcing) of the decision of a problem. The effect from outsourcing is reached at the expense of more rational, qualitative and cheap execution of transferred functions. The estimation is manufactured on comparison of the received results of outsourcing with traditional ways of increase of competitiveness. Difficulty of comparison consists that for today anybody in the world is not capable to analyse effectively an event in business, including transport logistics, owing to the speed of fluctuations in market economy, risks of the business.

One of the arguments in favour of outsourcing is absence of necessity for long-term investments in which for business dealing the company requires traditional-conservative manner – "all". Outsourcing allows the company to concentrate on own business, having

given not profile part of the business to the professional, simultaneously improving quality of servicing and cutting down the expenses and the client (material, monetary and time).

But today in the world it is a lot of examples (almost two third of projects), when offered outsourcing for the concrete companies, suffered failures in practice. It is possible to explain it complexity of making up of the concept of outsourcing (that we wish to receive), complexity of technology of functioning of outsourcing (how to receive wished) and absence of methodology of introduction of concepts of outsourcing in the company, including transport.

Experience of introduction of outsourcing in public catering, in cleaning and protection of objects and other simple spheres, which traditionally did not require in Hi-Tech is noted. Now outsourcing takes place in an information technology (IT), in financial and book-keeping servicing, bank both legal services and manpower. The most difficult kind is outsourcing business – processes. Its accurate determining does not exist till now, but its growth in the world countries even during the recession periods is observed.

1. In railway branch of Russia transport-logistical outsourcing of the organisation and servicing of transportations of passengers of separate kinds of transportation is expedient. They are frequently unprofitable, but are socially significant, great on volume and are constant on time and a place. Them concern:

— Suburban transportations, local and intercity,
— A through- through service «a city - the airport»,
— High-speed long-distance transportation,
— "Green" or winter routes of the day off,
— Excursion, family or a disco – rounds for youth other

The listed services not only take place for a long time in the developed countries of Europe, first of all in Germany, Switzerland and Austria, but also are transferred to outsourcing.

4. First experience of the use of outsourcing in the Russian Railways

The railway transportation of Russia is in the fashion in logistics to give on outsourcing increasingly more operations. As neither logisticians, nor do their clients, are not ready to outsourcing, the list of services which together with divisions is transferred to outsourcing – is very narrow. If in the West practically all logistics is transferred to outsourcing in Russia the bare operations are transferred to outsourcing (cleaning, protection, a warehouse, etc. basically). In detail anybody in Russia is not engaged in the outsourcing market though the

expert estimation of potential possibilities makes $50-50 billion a year, from them of 55 % it is necessary on freight forwarding and transportation, 32 % - on management of chains of deliveries (streams), and 13 % - warehouse services.

As outsourcing opens the companies access to the newest technologies, therefore JSC RZD considers outsourcing as the tool of increase of economic efficiency of the work. Conceptual preconditions of introduction of passenger outsourcing in JSC RZD concern:

1. Branch transition to the market, refusal of monopolism, reforming of branch in the conditions of a competition in the rail transport market;
2. Necessity of developing of profitable railway business (in wide socially – economic sense); and
3. Increase of an overall performance and quality of transport production, including passenger, at the expense of decrease in costs and a diversification of services.

In the conditions of crisis and transportation burden falling (only in 1st quarter of year 2009; by 25 – 30 %) are actual preserving of a sheaf the service provider – the client, on balance between its qualitative servicing and accompanying costs, without search of new clients.

For the decision of commitments of branch the huge investments concentrated on accomplishing of the main functions of a railway transportation – a shipping goods and passengers in multimodal transportation are necessary, without being sprayed on other or minor functions, in turn suburban and suburban - a city civil passenger traffic. Outsourcing in JSC RZD as a whole will give a number of side benefits: the domestic bureaucracy of branch decreases, the administrative personnel is being reduced, decision-making processes in branch and services is accelerated, contact to consumers and flexibility of reaction to their requirements and fluctuations in an environment improves. The means planned and involved on minor functions will be transferred to the main things business of JSC RZD, and the company will receive the big freedom of allocating of own investments into an infrastructure. Other advantage of outsourcing in JSC RZD is depreciation of the transferred functions: They are carried out by specialised firm-autsorserom in this area possessing the methods, technologies and experience. JSC RZD in turn will receive high quality of services for the same or smaller price owing to possibilities of a competitive choice of JSC RZD of the best company from among firms - аутсорсеров.

In a passenger complex of JSC RZD it is possible to carry the following to potential services of outsourcing: equipment and supply of rail cars; bed-clothes preparation; catering

services in trains and cleaning of rail cars and stations; the surveillance on operation and the maintenance of devices of a railway transportation; the surveillance of observance it is standard - technical regulations and documents on an arranging traffic of trains and its safety. They are partially realised on some roads (Privolzhsky, Northern, Gorki, etc.).

Potential of developing outsourcing on passenger railway transportation is much more the listed services. Almost all competitive kinds of passenger work can be deduced from primary activity on outsourcing, having left railroad communications only travelling facilities and the dispatching device, and also the functions which are traditionally making up image and shape of JSC RZD. At outsourcing introduction in railway branch it is important to specify its borders and to transform its "spontaneity".

For JSC RZD, except offered outsourcing of services in passenger transportation, a manpower, marketing functions and management of infrastructural capacities (station–travelling facilities and a rolling stock) can become a possible kind of transferred functions. The Operations procedure of railroad communications and decision-making process on transfer of concrete functions is specified in Position projects about outsourcing application on ЖД and the List of trades, services and the works recommended to ousourcingy (an order of 80 positions).

Today – ousourcer in JSC RZD it is possible to include in the list of the first companies:

- Group of the companies «Sign» serves 7 regions (Moscow, the Khabarovsk and Transbaikalian areas, the North Caucasus, the Amur and Kaliningrad areas), having cut down expenses of JSC RZD in year 2008, this level is on 10-15 % (economy of an order of 100 million rbl.);
- The Private operator of a rolling stock of JSC "UralKaliy";
- JSC "Alloy" in service of conductors on Northern railroad with annual economic benefit makes 8-10 % from expenses of passenger management of road; and
- The Samara company “Rikvest – Service” at Privolzhskaya railroad in service of preparation of bed-clothes.

The orientation on increase of profitableness of the basic business of JSC RZD, at the expense of simultaneous relieving of the basic business of unprofitable passenger functions should become the key factor of success of outsourcing, having transferred them only to what can cope with them better. The best way of introduction of outsourcing in JSC RZD is creation of the specialised enterprises, having designated them in the affiliated firms.

5. Outsourcing of a suburban civil passenger traffic

Despite their enormous volume as being compared with transportations of other kinds of customer grous, they are not for the Russian Railway core functions, and besides, they are unprofitable. Suburban tariffs for 38 % and even on 60 % below well-founded level, and predicted losses acritical 2008 - an order of 30 billion rbl. In the conditions of financial stock shortage in the best way of the decision of a problem is ousourcing of suburban transportations and transfer to their outage organisations, ready to become professionals in the business.

The Novosibirsk passenger suburban company «the Express train - suburb».

Today in Russia there operates 10 joint-stock suburban companies as affiliated firms of JSC RZD. Many of them were created on similarity of the Novosibirsk company. A railway transportation share in the market of suburban transportations more than 57 %. In a company authorised capital stock “the Express train - the suburb” 51 % of actions belongs to JSC "Russian Railway", 40 % - administrations of the region, 9 % mayoralties of Novosibirsk. The company which can be considered as outsourcing of suburban transportations, for 10 years of activity has transported 340 million people during year 2003. The company left on a work break-even sales level. Independence of the company and flexibility of decision-making have allowed to diversify services in 4 design directions: in traditional - suburban transportations and in 3 new:

- A city electric train (“the City railway”). In the winter on a city ply 17, in the summer – to 22 pairs electric trains a day;
- High-speed trains of the raised comfort “Siberian swallows”, for a year have transported an order of 326 thousand people In the long term start of electric trains "Aviaexpress train" to airport Tolmachevo is provided; and;
- Tourist's trains - hotels “Winter fairy tale”, only for year 2008. Have transported 6 thousand people.

For the sake of justice, it is necessary to notice that for the first time in the USSR such city electric trains (system GSZHD – Riga, or the City high-speed railway) were proved, technically developed by the author of this article in design materials of various degree of development, since year 1972. And including design engineering completed in years 1991–

1993. Partially tenders have been realised in 2008. In Riga the organisation of two pendular routes of city electric trains operates in city boundaries.

Sverdlovsk passenger suburban company "SPK" on Sverlovsk railroad has been organised in quality of ousourcer. Total amount of passenger on Sverlovsk railroad in 2008 were more than 60 million people For 2 years of life «SPK» became one of the best suburban innovative companies of Russia, occupying in Russia 3 place after Moscow and St.-Petersburg. It has 60 electric trains, 10 comfortable trains, and 130 rail cars on locomotive draught. Three years ago in Ekaterinburg there was a new kind of city public transport a city electric train. The daily stream has one-way reached more than 7 thousand people since 14th of October 2008. Openly regular traffic of electric trains in the report Sverdlovsk – Passenger – airport Koltsovo. For the sake of justice it is possible to notice that for the first time this idea has been offered in the monography of the author “the Railway in a city” in year 1986 (publishing house Transport).

The through railway service organisation «a city of Sochi – the airport Adler»

The project of the high-speed through- report “a city – the airport” is one of the major objects of the Olympic transport infrastructure, which should be realised and approved during year 2013, one year prior to opening of the Winter Olympic Games of Sochi 2014. The through service organisation “Sochi – Adler – the airport” (as a part of the future system of the City High-Speed Railway) provides building of a new railroad line from the item Adler to the airport in a valley of the river of Mzymta. A point of an adjunction of a line is the existing deadlock № 12 in a southern mouth of park "and" of station Adler.

Figure 1. A survey line from the item Adler to the airport of Sochi.

In Fig. 1 the Survey line from the item Adler to the airport of Sochi is presented. For possibility of continuous automobile traffic around World street the considerable part of a

projected railroad line settles down on a platform, with height of a support of an order 8 m, at the general height of an engineering construction with passing train of an order of 19 m. The sizes of a platform provide a dimension of journey of all types of transport in a zone of city building and the airport.

The landing flat (length 160) for the passenger aviaterminal takes places below an existing highway on the Red Glade. The platform has a building, “кассово – турникетный” pavilion of ticket purchases, and two foot galleries adjoining the second floor of an aerostation complex "Sochi".

The cores technical – economic indicators of a new line of an adjunction by the definitive claimed variant (as of 14.05.08):

1. A road Grade – IV, a track - 1520 mm, number of the main roads - 1,
2. Number receiving - dispatch roads of stopping point «Airport of Sochi» - 2,
3. The general extent of a line – 2.83 km, including new building – 2.76 km,
4. Artificial constructions: retaining walls – 0.98 km, length of a road on a platform – 0.8 km, length of 2 tunnels – 0.532 km)
5. Length of a road on an earthen cloth – 1.428 km, on a platform – 2.773 km,
6. The maximum bias – 3.8 – 4.0 %,
7. The least radius of curves: horizontal – 300 m, vertical – 3000 m,
8. Technical speed of traffic of electric trains – 57.8 km/hour,
9. Time of a course of an electric train from the item Adler to Airport – 5 mines, in the opposite direction – 4 mines,
10. Time of a turn of one electric train Adler - the Airport – 40 mines and Sochi - Adler - the Airport – 115 mines,
11. Capacity of an electric train (depending on rolling stock type) – 250 – 380 passengers,
12. Total amount of transportations in average days, without the Olympic Games – 5.2 thousand passengers,
13. Total amount of transportations a year, without the Olympic Games – 1.9 mln. passengers
14. The sizes of traffic – 8 steams of trains a day, without carrying out of the Olympic Games,
15. The rolling stock–1 railroad train for traffic on a site of Sochi – Adler – the airport of Sochi, without carrying out of the Olympic Games,
16. The stopping complex in railroad train:
    • A landing platform (length 160 m and width 5 m),
    • 2 foot galleries, length 117 m and 108 m,
    • Admission rate of foot galleries – to 2 thsdnd. Foreheads / hour,
    • кассово – ”турникетный” pavilion (area) – 660 sq. m,
17. The total cost of building of a railroad line – 2.52 billion rbl.

Specified in the beginning year 2008 that the requirement of investments for preparation of a railway infrastructure for carrying out of Olympic Games of Sochi – 2014 will make an order of 6 bln. Rbl. at the expense of the investment program of JSC "Russian Railway",

including on year 2008 – 0.5 bln. Rbl., on year 2009 - 2.47 bln. Rbl., on year 2010 – 3.03 bln Rbl.

Offered tracing of roads of a direct adjunction to the airport will provide possibility of use existing (but modernised) the main and new tracks as the structural block of projected system of the City high-speed railway GSZHD – Sochi that will provide efficiency and profitability of their work.

The recommended system of high-speed delivery in the airport as a part of projected system GSZHD – Sochi completely provides settlement loading on an arrival (start) of air passengers in the airport of Sochi, claimed in the Application book of the IOC - 3800 people per hour (the maximum volume of passenger traffic in a rush hour - 4800 foreheads) with granting of comfort and sufficient level of convenience to achievement of the purpose of a trip.

Recommended multipurpose system GSZHD – Sochi is intended for a high-speed rail traffic not only between Sochi (including artificial Island of Federation) and the Aerostation complex in Adler, but also between settlements at coast (Tuapse, Lazarevsky, Loo, Vardan, Dagomys, etc.), without demanding building of additional roads of the big extent.

The main lack of an offered line and claimed ГК "Olimpstroj" is absence of direct continuation in the Krasnaya Polyana and the Olympic centre in Imeretinsky lowland that contradicts IOC requirements. In the General layout these direct high-speed railway communications from the airport and in settlement Cheerful Imeretinskaya lowlands are recommended for the Krasnaya Polyana, but is postponed for the second stage of realisation of the General layout of agglomeration of the Big Sochi.

The best way of operation of the given site in Olympic and the resort seasons, providing profitability of transportation and high quality of a trip of passengers, is outsoursing completed within a way that special private company has been established.

6. Conclusions

Introduction outsourcing business in Russia – process in the organisation suburban passenger traffic will provide competitiveness of any passenger company on a complex of the following indicators which exact railroad train depends on character of activity of the company:

- Quality of given passenger services. Here concerns: availability of stations and stations to the passenger, convenient and safe approaches to platforms, presence of escalators, lifts and running paths on landing platforms, comfort and convenience of a trip in rail cars of the improved layout and fitness of a used rolling stock to fast and

safe landing/disembarkation of passengers, including people with the limited possibilities etc.;

- Increase of a degree of service of passengers regarding routing of a network, convenience of the schedule and the traffic schedule, its execution “is on exact with time”, routing and network frequency of following of trains, compatibility of a train schedule and nearby location of mass types of transport;
- Speed and accomplishing time of logistic passenger services, including speed of reception of a vehicle, a queueing time at-halt and at changes, speed of a traffic and time of a full trip of the passenger “from a door to a door”;
- Decrease in expenses of the manufacturer – the operator of passenger services: operational - at cost of e/energy, materials, the salary and capital expenses on engineering – serving constructions and rolling stock acquisition, on innovative technologies and the software, etc.; and
- Decrease in expenses (money and time) the consumer of passenger services - the cost price and payment of a trip for the passenger on various types of transport, ticket – tariff system and travel privileges), etc. For example, JSC RZD and company "Vympelcom" (the owner of a brand in mobile telecomm. "Beeline") in the near future in 2009 will start the joint project on realisation of tickets while distant following e-ticket (in the Western Europe probably and for the suburban traffic) by means of mobile phones that does passengers socially by more mobile.

Even the large companies cannot solve a problem of improvement of the listed indicators simultaneously, in a kind of constant absence of time and means. The profit at the expense of reducing of the expenses, instead of ephemeral quality of servicing of the passenger and its constant increase becomes the main thing for any company in the conditions of economy globalisation.

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The process of liberalizing the rail freight transport markets in Hungary: market entry conditions and competition dynamics

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Abstract
The process of liberalizing the rail freight transport market in Europe has not been proceeding with great success since 2004: the literature verified that the main reasons for this is the lack of financial means for investments into rolling stock with related interoperability enhancement and the complexity of procedures included into national regulative/institutional specifications. The purpose of this case study is to investigate the quality of the difficulties of rail service providers in expanding their operations on the transport markets in Hungary. The main findings reveal that the old incumbents are increasingly collaborating as one "united partner group" against the newcomers. Ad hoc requirements in the inspection procedures for necessary licenses are often seen as a major obstacle. High track access charges and the framework format of EU legislation are considered as well to be significant problems whereas the availability of well educated human resources is not seen as a serious market entry constraint.

Keywords: Rail freight transport, liberalization process, market entry barriers, EU, Hungary

1. Introduction

During the last two decades many EU countries have embraced on revitalization concerning their railway industry. As these endeavors are rather complicated, expensive and lengthy system projects vast attention has been paid to them both by private entrepreneurs and public media. In Europe EU adopted so far two directives packages and through these centrally built policy agendas member states are to carry out their restructuring initiatives (Volkenandt, et al. 2007; Eisenkopf 2006a). In this research report the case of MAV Cargo is put under investigation in general and evaluation is done as to how well the input efforts can help Hungary to get forward with its aim to reengineer its railway industry. In this study privatization is defined as the transfer of ownership of rights and assets from public to private control (Väätänen 2008).

It is considered that privatisation of former monopolies is part of the liberalization process of the railway industry together with deregulation and other regulatory measures so as to make the whole sector more competitive in comparison to road transport. The research question is as follows: What are the most significant entry barriers onto the markets in Europe in general and in Hungary in particular experienced by private rail freight service providers. In Section two a literature review is provided on market entry barriers to rail freight markets in Europe and the article summaries on the privatization of MAV Cargo Ltd. are presented.

Section 3 reveals the research methodology and Section 4 draws conclusions based on the literature and the cases.

2. Literature review on market entry barriers to rail freight markets in Europe and MAV cargo privatization

Despite the efforts in Europe to revitalize the rail freight sector to become more competitive, railroad has a long way to go to regain its lost position: in 2008 only 10 percent of all cargo was carried by rail against 44 to that of road (EU 2008). According to the existing literature the main reasons for this are lack of investments into rolling stock, innovative interoperability measures for infrastructure, and the complexity of procedures of regulative/institutional specifications (Borger et al. 2009; Ludvigsen and Osland 2009; Islam 2009; Sorgetti 2009; CER 2009; EU 2008; DHL Logbook 2008; Thompson 2008; Mäkitalo 2007; Hilmola 2007; Bokor 2007; Eisenkopf 2006b).

In this sense Hungary is a typical example: the share of rail freight in the overall modal split in comparison has come down in comparison with road freight transport during last five years: in terms of tonnes rail lost 107 thousands tonnes between 2004 and 2008, whereas road gained more 44927 thousand tonnes.

This same tendency is exemplified by tonne-km: during the same period rail showed only 1068 millions tonne-km increase whereas road transport gained 15136 millions tonne-km more. At the same token it has to be stated that the role of international transport stayed dominant: it counted for about 80 percent out of all transportation during this interval. (Hungarian Central Statistical Office 2008.)

MAV has been long a company carrying the debts of the past and this fact forced the management of this rail operator to take more radical actions to bring away the company finally from the red line (HVG 2007c). Between 2004 and 2007 still managed to reach a better result by pressing down the losses: during this four year period net loss dropped by almost 10 fold from 171 thousand EUR to 17 thousands EUR (MAV Annual Report 2005 and 2007). The freight cargo side was almost all the time the division able to provide profits, but it could not compensate the negative results produced by the passenger operations (MNO 2008).

In the end declining shares of rail freight out of the total freight haulage markets in Hungary, pressure for further infrastructure investments and the real threat of a forthcoming credit crisis made it inevitable to do something quickly and in an efficient manner (Hungarian

Transport Authority 2009; Eurostat 2009; Finn 2008; The Economist 2007; HVG 2007c). In the following the article summaries are presented with a short comment on the topic after each Table.

Table 1. Selected articles from the online portal of "Index.hu"

Author and Title	*Major arguments*	*Additional information*
Index (2008a) The Police is investigating the privatization of MAV Cargo	The police is initiated an investigation to have information why Geuronet Ltd. was given a chance to profit from the privatization of MAV Cargo. MAV Cargo confirmed that it has never been in any official contact with this private consultancy firm.	This special consultancy agreement was signed in June 2007 between Geuronet Ltd. and RCA. From RCA the contract was signed by Gustav Poschalko who is a member at the management board of the incumbent operator of Austria.
Index (2008b) RCA argues that the firm accused of lobbying did a decent work	There are strong evidences that a third party – an independent private consulting firm Geuronet Ltd. based in Budapest received an extra award from the RCA equaling to 7.1 million EUR for "assisting" in helping RCA to be the winner in the tendering process.	The spokesman of RCA argued that 1.75 percent "success award" is well presented in the international business life. In this way RCA wanted to ensure the positive image of Austrian firms in Hungary.
Index (2007c) The employees of MAV insist of 28 billion forint compensation	The union of workers of railway association of Hungary has issued a statement according to which it requires MAV to pay the 36 thousands employees approximately 27 millions EUR. This is because the privatization was more successful than initially could be anticipated.	The sum of money required to be paid by the union is equal to two and half month salary of each employee of MAV. The human resource expenditures are huge at MAV: more than 500 millions EUR per year according to HVG.
Index (2007d) Is the price for MAV Cargo far too high?	According to consultant firms in Austria the price that the consortium of RCA and its partner GYSEV Ltd. are to be to transfer to MAV is far too high. The main argument is that the fleet of cargo wagons of MAV is so old and in so bad conditions that they are not usable anymore.	An additional reason that gave birth to criticism is that the purchasing consortium promised to MAV that it would guarantee the continuity of positions held by employees at MAV in the future.
Index (2007e) The value of MAV Cargo is equal to a Postbank	The income from the privatization of MAV Cargo will be primarily distributed inside MAV Cargo to smooth the consolidation process. The employees can be certain their jobs are guaranteed in the future. According to MAV Cargo the privatization was a huge success.	The price RCA is due to pay is approximately 400 millions EUR that sum of money is 35 times higher than the profit generated by MAV Cargo during the year of 2007. The employees are entitled to a dividend package at half price that RCA is to be purchase back at full price.

Concluding on the information presented in Table 1 it can be argued that the privatization of MAV Cargo was a major source of income also for other parties outside two incumbents.

Table 2. Selected articles from a weekly business magazine of "Heti Vilag Gazdasag"

Author and Title	*Major arguments*	*Additional information*
HVG (2008a) The game of gauges	It is argued that the way the privatization process was finalized with the sales contract does not represent a meaningful manner of preserving the real value of MAV Cargo for Hungary: future incomes can be easily directed for the sole benefit of RCA.	In addition MAV had to give a guarantee for RCA that it will not increase the truck access charges so that RCA would suffer. If charges rise however MAV has to pay RCA compensation up till 100000 EUR. The government must still renew the system principles behind charging for accessing trucks.
HVG (2008b) The main architect of MAV-scandal is about to resign	It is claimed that in secret, the ministers in charge for supervising RCA has reached a decision to dismiss the CEO and the Vice CEO of RCA. The core argument behind this move was the scandal after involving Geuronet Ltd. in the privatization process.	The CEO Mr. Martin Huber is accused of extracting 5 millions EUR out of the agreements pertinent to the privatization for private purposes. The Vice CEO must resign as well as he was the one that signed the agreement with Geuronet Ltd.
HVG (2007c) The weight is getting light	There is a scary scenario was revealed according to which Slovakia and Slovenia might gain significant benefits out of the controversial development policy for transport. In practice the Hungarian government ends up supporting much more rail passenger and road transport.	It is estimated that currently about 10 percent out of the volumes is directed toward the lines in Slovakia and Slovenia, and in physical terms it is equal to the amount of traffic of 4-5 millions tonnes.
HVG (2007d) MAV Cargo: the best offer came from the Austrian consortium	It is stated that the offer of the Austrian consortium was far the best one among the three considered: the sale price was approx. 400 millions EUR. The second best offer promised around 330 millions EUR and the third best offer proposed 220 millions EUR.	There was a broad consensus among government officials, company management and worker unions that this accepted offer was the best, not only in terms of sales price. The Austrian partner promised to invest the greatest amount of capital during the forthcoming years.
HVG (2007e) In Austria it is considered that the price of MAV Cargo is far too high	Despite the confirmed contract, in Austria government officials claim, the price for MAV Cargo was far too high. In the first place it was stated that the wagon fleet owned by MAV is outdated and not suitable for efficient use.	The subsidiaries of the federal rail consortium of Austria are present in 23 countries around the world. If the takeover of MAV Cargo would succeed, it would the first time that RCA gains a dominant position in the market of another country.

Table 2 articles suggest that the MAV Cargo did not manage to take into consideration all the consequences of the sales contract and Austrian economy won more with the transfer of ownership compared to Hungary.

Table 3. Selected articles from influential newspaper of "Nepszabadsag" (NOL)

Author and Title	*Major arguments*	*Additional information*
NOL (2008a) Ministry of Transport: There will be no problems with the sale of MAV Cargo	According to the Ministry of Transport and Communications there is no any faults in the agreement that specifies the conditions under which MAV is to be merged to RCA. The government is not going to help GYSEV to gain greater foothold in acquiring dividends of MAV Cargo.	The new owner consortium can apply for compensation if the Hungarian government decides to set the track access charges higher in January 2011. However in case tariffs of track access charges rise, the increase will be of minimal percentage wise.
NOL (2008b) The sale of MAV Cargo might face a dead end	Hungarian government officials claim that there are many clauses in the privatization agreement between MAV and RCA that may result in significantly less income for MAV in the end. It is even possible that the deal will not come true at all.	The government official did not want to reveal what kind of serious faults have been noticed. But they told that the final decision of allowing the contract to enter force is up to the prime minister of Hungary.
NOL (2008c) 26 billion forint away from MAV Cargo	GYSEV requested Hungarian government officials to help to finance its plans to get 25 percent shares of the dividends of the purchased MAV Cargo. To achieve this goal GYSEV would have to inject almost 100 millions EUR into the privatization contract.	In the end of May 2008 there were 16 new operators on the rail freight transport market in Hungary, but still MAV Cargo is by far the most dominant player. The market functions inefficiently due to cumbersome border crossing procedures and high track access charges.
NOL (2007d) 102 billion forint was the price of the deal for MAV Cargo	The offer of the Austrian consortium was approved because it recognized most the real needs and expectations of MAV. The price for MAV Cargo was not the only decisive factor. There were even offers that were ignored completely.	It can be stated that the Hungarian government did contribute in a significant manner to the privatization contract: there was a guarantee given that during the first two years of operation it will not increase the amount of payment related to track access charge.
NOL (2007e) 12 competitors are running for MAV Cargo	After the first round 12 offers have been received. Among others Deutche Bahn, Rail World and Mid Europe Partners are interested. The Hungarian government does not see rail freight operations bearing strategic importance in the economy.	Initially also PKP Cargo was about to take participation in the tender but in the end it did not submit an application. There was another interesting party involved at this first stage as well: Cfr Marfa from Romania. It is the market leader in that country and is the former incumbent operator.

It can be claimed based on articles shown in Table 3 that the there were no firm procedures defined how the privatization process would be managed or controlled.

Table 4. Selected articles from influential newspaper of "Magyar Nemzet" (MNO)

Author and Title	*Major arguments*	*Additional information*
MNO (2008a) Police investigations continues in the case of MAV Cargo privatization	Ltd. received serious amount of compensation of some unrevealed consultancy from RCA. MAV Ltd. emphasized that its procedures to compare offers during the tendering process were in line with the law.	Hungarian Central Police Agency revealed that they first investigated the matters for several months and only after that the matters was decided to take forward. It may well be that the investigation will last long up till the end of 2008.
MNO (2008b) Interview with the key person behind the privatization of MAV Cargo	The real incentives to privatize MAV Cargo were activated as it became evident that without strategically partners MAV Cargo cannot keep its most important clients. The freight rail market is fragmented in Europe and cooperation is needed to increase shares against road transport.	MAV management board saw GYSEV as a partner able to mitigate the risk of failure in implementing the development plans concerning MAV freight operations. GYSEV is a flexible company and their management concepts are to be implemented in MAV Cargo revitalization plans.
MNO (2008c) Ministry admits	The representative of the Ministry of Transport and Communications of Hungary revealed that the contractual matters are under investigation by competition agencies both of Austria and Hungary.	EU high status officials are also aware of the intransparent contractual clauses pertinent to the privatization contract signed between MAV and the Austrian consortium.
MNO (2007d) Life generated from the price of MAV Cargo privatization	Along the sale of shares of MAV Cargo the company aims at issuing new bonds on the market and selling some valuable properties to ensure continuity of operations. The CEO of MAV Cargo considers the new owner as a great victory for the future of MAV Cargo.	It is almost guaranteed that the new owner will take away from Hungary the management groups of human resources and accounting, but there is no decision yet about the future of sales and marketing team.
(MNO 2007e) MAV Cargo: the golden egg is given away with the approval of Koki?	It is claimed that the central motive behind the intention of RCA to acquire MAV Cargo was the possibilities to control into a large extent the transit cargo flows both in east- west and north-south directions.	MAV as a whole was a loss making firm since 2002 and new management concepts were needed. MAV has access now to new transport models such as ROLA that facilitates trucks being transported on rail wagons.

The information in Table 4 confirms that there were many contradictions around the sale of MAV Cargo and there were many important issues that were kept in secret by the partners of the sales contract.

In overall it can be concluded that there was a public fear in the air already very early on that the privatization of MAV Cargo Ltd will not help the rail freight sector to become more profitable for the benefit of Hungary. Instead this development was depicted to be a dangerous one possibly imposing more negative than positive effects on the economy. Despite these facts can be proposed that financial considerations were at the core of the aims of privatization and MAV reached a good deal. RCA might bring well prosperity in the future too in collaboration of Deutche Bahn, but this requires right infrastructure investment decisions and a proper track access charges system. Still in the contract of sale of MAV Cargo there is great amount of room for adjusting the interest of both parties to the actual economic circumstances relevant during the forthcoming years. MAV and RCA considered that a merger of these companies would be a best option for making rail freight more competitive against road transport in this region.

3. Research methodology

This study employs a case research methodology, focusing on the evolution of railway industry development process. The main purpose is to shed a light on new finding still building on the existing ones: thus this scrutiny can be seen as a cumulative case study based on both deductive and inductive approaches (Hilmola 2003). MAV Cargo privatization project is scrutinized with a literature review based on Internet resources: The analyzed 20 articles have been published between July 2007 and July 2008. The validity of Internet resources is ascertained by taking different databases that discuss the title “privatization of MAV Cargo”: One certified weekly business magazine (HVG) supplemented with two other nationwide newspapers provided the range of information and an online news-portal (Index). In addition to increase the quality of conclusions, also other international news agencies, academic literature and governmental agency reviews were scanned.

The cases were written on basis of face to face interviews with people belonging to the top management group of the illustrated companies. Out of the 10 rail operators in the market four responded providing for the rate of answering 40 percent. In addition three other potential future rail service providers were visited. In order to be able to ensure the validity

and reliability of contents of the cases first the targeted firms received a brief description of the objectives of the study. The interviews were accomplished during March 2009 based on semi-structured questionnaire. After having finalized, the texts were sent back to the cooperating representatives of the enterprises involved to be checked that the written material was acceptable.

4. Discussion

All the material presented may suggest that RCA might bring well prosperity in the future too in collaboration with other regional rail operators and logistics service providers. This prerequisites firm sources for infrastructure investments and common, transparent logistics transport processes built upon common norms with the corridor – approach (DHL Logbook 2008; Sames 2008; Analytiqa 2008; Berényi 2008; Ludvigsen 2007; Wiebe 2007; Berényi 2007; HB-Verkehrsconsult GmbH and VTT Finland 2006). However the recent major drop in transported volumes of freight cargo as a result of economic downturn in Central Eastern Europe hinders into a great extent the realization of these objectives in the long run (Hungarian National Transport Authority 2009; HVG 2009; Hungarian National Competition Authority 2008c).

It can be claimed that the privatization process of MAV Cargo in Hungary was targeted at maximizing profits for the sake of shareholders at the short term and not that much to stimulate competition or reconstructing the market (Hungarian National Competition Authority 2008a; Hungarian National Competition Authority 2008b; Hungarian Rail Office 2008). The output of case studies supports well this line of argumentation (see Tables 5a and 5b below). Companies A, B, C and F are operating on the rail freight markets while firms D, E G are only considering of entering. Still it can be stated that in most cases the main reason to enter markets are to increase revenue or cut costs and the main barrier to proceed with market entering can be associated with the actions of MAV Cargo. Nevertheless it can be argued that from a short term perspective this measure of merging MAV Cargo with RCA was a right one in the sense that it ought to bring financial stability for the Hungarian operator. In the long run, however, this sales contract might benefit much more the Austrian rail service giant as it will be able to dominate the Hungarian and Central European markets and compete against Deutche Bahn (Sorgetti 2009; Koós 2008; Pittman 2008; Carruthers 2008; Business Monitor International 2008; 168 ora 2008, Ludvigsen 2007). It seems that in

the near future in the EU in many regions oligopolistic competition will become a more significant factor in the rail freight market. This is not the optimal case for the industry and the vertically integrated rail giants will continue to cut out the potential existing free space in terms of volumes.

Table 5a. Summary of the finding of the interviews with the case companies (active rail freight operators).

Measure/Company name	Company A	Company B	Company C	Company F
Year of establishment	2003	2005	1872	1996
Size of the company	Small	Small	Medium	Small
Backgroud of the company	New	Rail construction	Rail engineering	Other transport firms
Personnel's background	MAV + acquired	MAV + acquired	MAV & acquired	Acquired
Management of the rolling stock	Own and renting	Renting	Own & reenting	Own & renting
Reason for entering the markets	Increase revenue	Increase revenue	Increase revenue	Expand markets reach
Main market entry barriers	Actions of MAV Cargo Inspection procedures High access charges	Actions of MAV Cargo Inspection procedures High access charges	Ad hoc requirements related to documentation	Actions of MAV Cargo High access charges

Table 5b. Summary of the finding of the interviews with the case companies (potential market entry candidate rail freight operators).

Measure/Company name	Company D	Company E	Company G
Year of establishment	2007	1993	1967
Size of the company	Medium	Small	Medium
Backgroud of the company	Transshipping (MAV)	Rail construction (MAV)	Energy sector
Personnel's background	MAV	Acquired	Acquired
Management of the rolling stock	Own & MAV old	Own	MAV & Own
Reason for entering the markets	Value added services	Costs savings	Costs savings
Main market entry barriers	No demand Inadequate infra in the region	Market uncertainty Cumbersome application procedures for licences	Actions of MAV Cargo Market uncertainty

In the future the situation might change toward “with collaborative competition toward productivity” (see Vogt 2008) oriented philosophy, as the intermodality considerations included in the “corridor – approach” of research and development transportation projects will take deeper effect in Hungary (Rail Cargo Austria 2008; Zomer and Islam 2008; Božičnik 2007; Rushton and Croucher and Baker 2006).

5. Conclusions

Based on the theoretical part of this study supplemented with a literature review, it can be concluded that private freight rail operators will have to form a strong alliance network among them in order to be able to increase their shares on the market. Even though there are nowadays many private railway undertakings on the market with valid operation license, MAV controls still the rules of competition. Based on the case studies completed it can be argued that potential candidate firms have difficulties in entering the markets in Hungary mostly because of power of incumbent operator in setting up preventing measures. For example the terms of forwarding agreement is often manipulated by MAV Cargo. Ad hoc requirement included in the inspection procedures for meeting the conditions of operation and safety certificates are considered as a significant obstacle as well. On the other hand the availability of well educated human resources is not seen a serious market entry constraint in Hungary.

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Finnish paper industry's joint SCM concept, implementation evaluation

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Abstract
The main objective of this research work is to describe Finnish paper industry's joint supply chain management concept and to evaluate the implementation of the concept. The SCM concept was originally developed in 2002 jointly by four paper producing companies and by three logistics service providers. The evaluation was done based on interviews, which were done in October – December 2008. The core findings show, that the concept itself follows main guidelines, given in the SCM literature. The concept implementation has not been successful for all partners especially for the logistics service providers and especially for logistics planning information. The EDI- messages used for performance reporting between the partners is one successful element in the concept. The evaluation shows, that there are still plenty of improvement possibilities for all participating partners. Current production structure at the end of 2008 with decreasing production volumes should force the participating companies to collaboratively reduce costs and improve operational efficiency.

Keywords: Collaborative supply chain concept, implementation evaluation, paper industry

1. Introduction

Due to the geographical position of the Finnish forest industry, the Finnish forest industry has a 10 per cent additional transport cost compared with the European competitors. Annual transport costs for the Finnish forest industry are estimated to be EUR 650 million. Each year the forest industry transports about 100 million tones of goods within the country, and about 20 million tones of imported and exported goods are transported every year. The forest industry accounts for about 60 percent of rail tones kilometers (distance x tones) in Finland, about 30 percent of road tones kilometers and 45 percent of exports by sea. About 75 percent of the forest industry's raw materials and end products are transported by road in Finland and just under 25 percent by rail. Rail transport is best suited for large consignments, which are regularly transported over long distances, while road transport lends itself to smaller consignments over shorter distances (FFIFF 2005, 11).

The paper production capacity of the Finnish paper mills was in 11.2 million tons in 2004. 92 percent of the production was exported. Paper was produced in 28 paper mills. The paper board production capacity was 2.8 million tons and 89 percent of the paperboard products were exported. The pulp and market pulp production capacity was 15.1 million tons. Major part of the pulp was consumed on the domestic market (92 percent). The share of export for the market pulp was 92 percent. The production of sawn timber was 13.5 million cbm and the 62 percent of the sawn timber products were exported. The plywood production was 1.4 million cbm and the share of export was 86 percent (FFIFF, statistical web-service, 2006).

The high level of forest industry exports proves that all Finnish forest industry companies are very much dependent on the supply chain management solutions to the main markets.

The Finnish paper producers have 20 percent market share of global printing and writing paper exports. The market share for paper and paper board exports is 12 percent. Finnish forest industry producers have ten percent market share of total forest industry exports. The market share of the global production capacity is five percent (FFIFF, statistical web-service, 2006).

The turnover of Finnish forest industry companies was 35.4 billion EUR in 2003. The turnover split for the production located in Finland per receiving countries shows that Germany has 14 percent of the total turnover. Great Britain has 12 percent, Finland 11 percent, France seven percent and Sweden five percent. The other EURO countries have 15 percent and other countries in Europe have nine percent and other EU countries have three percent of the total turnover 2003. North America has 12 percent, Asia five percent and other countries have seven percent. The biggest market changes have occurred on the Finnish market where the turnover has been falling from 50 percent to 43 percent of the total turnover. The Northern American market has shown an increase from 11 percent to 15 percent of the total turnover (FFIFF 2002, 2003 12, 12 and FFIFF, statistical web-service, 2006).

The Finnish forest industry groups have been doing capital investments during the last five years more abroad than in Finland. The capital investments in Finland have been less than 1.8 billion EUR per year (1997-2005). The capital investments abroad have been approximately 10 billion EUR during year 2000. The capital investments abroad have been used mainly for purchasing new production capacity and for mill refurbishments on the main markets. The tendency has been between years 2000 and 2005 that major part of the investments has been done in production facilities abroad (FFIFF 2002, 2003, 13, FFIFF, statistical web-service, 2006).

2. Literature review

Supply chain management and other similar terms such as “logistics management”, “network sourcing”, “value chain management”, “supply pipeline management” and value stream management have been receiving increasing attention from academics, consultants and from the operational and strategic management of the companies (Scott and Westbrook, 1991, 23–33; Saunders, 1995, 476-485; Cooper et al., 1997 a, b; Tan et al., 1998, 2-9. These terms

describe the integration of those business processes that start with the supplier's suppliers and end with the customer's customers. These business processes cover order handling, production, delivery of goods and services to the final consumers. According to this business process based approach, the companies do not seek cost reductions or profit improvements at the expense of their supply chain partners, but rather to make the supply chains more competitive as a whole.

Supply chains can be understood as a mutual dependence between firms in marketing channels (Alderson, 1957; 1965; McCammon and Little 1965; Stern, 1969). Existing interdependencies create a basis for collaboration between the companies in order to achieve individual and mutual goals. Supply chains can be regarded as single entity (Alderson 1965), a super-organization (Stern et al., 1996) or a social system (Balderston, 1964, 176-189) that consist of independent companies which are distributing products to the consumers.

A growing range of goods, higher number of customers, more orders per customer and decreasing order sizes are the basic driving forces to the increased importance of the supply chain management. The competition structure between the companies has changed. Competition is no longer one company competing with other companies, but one supply chain is competing with other supply chains. (De Souza, et al., 2000, 348)

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There are several ways of defining the supply chains on a generic level:

1 The supply chains are an integrating philosophy to manage the total flow of a distribution channel from supplier to ultimate customer (Cooper and Ellram 1993, 1-10).

2 A strategic concept that involves understanding and managing the sequence of activities – from supplier to customer – that add value to the product supply pipeline (Battaglia and Tyndall, unpublished, 1996).

3 Integrative management of the sequential flow of logistical, conversion, and service activities from vendors to ultimate consumers, necessary to produce a product or service efficiently and effectively (Stenger and Coyle, 1996).

Cusumano, (1985, 1994); Håkansson, (1987); Contractor and Lorange, (1998); De Bresson and Amesse, (1991, 363-379,): Thoburn and Takashima, (1992) have described

supply chains as inter-firm productions relationship. In these organizations coordination between the companies of the procurement-production-delivery cycle is a prerequisite to build effective supply chains (Lamming, 1993). In order to make the coordination successful, the companies have to agree on joint organizational and logistics integration rules.

Supply chains are normally a sum of collaborative business processes between several partners. Mentzer et al. (2000, 52-58) define supply chain collaboration as a long term relationship among partners which area actively working together as one toward common objectives. Several authors have been analyzing the collaborative functions of the supply chains. Andraski (1999) concludes that supply chain collaboration is a business tool that builds the sales. Citera et al. (1995, 551-559) defines the supply chain collaboration as an interaction among peers sharing a common set of goals and measures. Haeckel's (1998, 63-71) defines supply chain collaboration as a process for the partners to jointly search solutions. Sriam et al. (1992, 303-320) defines the collaboration as a relationship in which trading partners develop a long term cooperative effort. Alvarado and Kotzab (2001, 183-198) define supply chains also as "an integration of business processes among channel members with the goal of better performance for entire channel system". Carbonara et al. (2002, 159-176) define supply chain management as "the integrated and process oriented management of material and information flows, which connect the source of supply to the end customers, with the aim of producing value for the customers, by improving customer service and lowering costs".

However, supply chains can be defined in several different ways, but the essence of a supply chain is the integrated management of the sequential flow of materials and associated activities from vendors through to the ultimate customer. The effective management of a supply chain requires certain key characteristics, pipeline co-ordination and seamless flows of inventory, focus upon landed cost to customer, sharing information and risk, planning based on supply chain team and strong partnership or alliances (Coyle et al., 1996, 22). According to Coyle et al. the supply chain management is the managerial tool for planning, operational supervising and financial control of the supply chain (Coyle et al., 1996, 22).

3. Research methodology and the motivation for the study

This research describes a joint supply chain management concept, which has been developed by four Finnish paper producing companies and by three logistics service providers. The strategic target was to implement uniform supply chain operative rules in all Finnish ports including the logistics service providers. The concept included both daily operational rules and EDI- messages.

This article is a typical case study, as it describes supply chain operational rules including information flows, which are vital elements in the supply chain management of the Finnish paper industries. This article is descriptive based on the concept description, which was jointly agreed by the participating companies.

The evaluation of the concept implementation is based on interviews with selected persons representing the participating companies. The concept was developed and agreed for implementation in 2002 and the evaluation interviews were done at the end of 2008, when there were already strong signals for decreasing export volumes due to the closing down of several paper mills.

The motivation of the study is based on practical experience of the author. Working together with the Finnish paper industry and with the logistics service providers during the last years, clearly shows that some of the elements of the joint supply chain management concept are implemented daily, but in some areas no improvement can be recorded.

4. Finnish paper industry supply chain management, main processes

The Finnish paper industries developed a joint supply chain management strategy based on purely operational processes in 2001. The development work was initiated by the logistics service providers, who were suffering from daily disturbances in their operations. The supply chain management concept is called as “Intelligent Supply Chain”, (ISC-concept). However the ISC-concept has not been implemented collaboratively, the paper producing companies are implementing the jointly agreed operational processes on individual company level.

The Intelligent Supply Chain reflects the recent changes in supply chain management thinking of the Finnish paper industry. In the past, paper shipments have been considered as bulk shipments, but the current need for supply chain management requires that each package have to be identified in the supply chain. The Intelligent Supply Chain reflects also very

strongly the new demands from the customer's side. The customers require the use of package identifications in each moment in the supply chain (interview, senior vice president, logistics, company A, 9th April 2001). The ISC-concept was developed for the paper industry's supply chain starting from the producer (paper mill) and ending to the final customer. The hinterland transports (railways and trucks), port operators and the shipping line are included in the concept. The order handling and production planning were excluded from the development work.

There are four "philosophical" elements, "cornerstones" in the ISC-concept: Commonly agreed way of working, supply chain management, data integrity and logistics planning. All of these four major elements are described in the text below (EXPRO report, 2001).

ISC cornerstone 1: Commonly agreed way of working

The intelligent, transparent warehouse is called Intelligent Supply Chain (ISC), which means interactive work between the logistics service providers. The daily work of the logistics service providers is understood as a warehouse component in the ISC-concept. The ISC-concept is a jointly agreed way of working between the mills and the logistics service providers. The commonly agreed way of working is valid only if all partners commit themselves to the common rules. All partners in the supply chain can implement ISC-concept.

ISC cornerstone 2: Supply chain = warehouse

The supply chain from the mill to the final client can be seen as a stock where the cargo is moving from one stock position to another. The cargo movements are done physically by the logistics service providers. This means that the activities of the service providers are considered as components in the ISC-warehousing. ISC-warehousing has two different statuses: static warehousing (permanent), stock at the mill, stock in the port, stock in inland destination and dynamic warehousing (moving), such as trucks, railway wagons and vessels.

ISC cornerstone 3: Data integrity

Leading principle for data integrity means that at any point the party dispatching the goods is responsible for the physical flow of goods and the respective set of data to be equal and due,

by timeliness and accuracy. The role of data integrity is also described by Kurnia and Johnston (2001, 237). The authors point out that data integrity plays an important role in cross docking where the operation is normally handled with a rapid speed and incorrect information would lead to operational delays. Christopher and Jüttner (2000, 117-127) argue that data accuracy is the primary concern for system development and not the degree of automation or sophistication of the technology. Data accuracy is the source in order to reach the required level of data integrity. At any time, on any issue all relevant parties will have equal data awareness available.

ISC cornerstone 4: Logistics planning

Logistics planning is based on consistent receipt of structured advance/preplanning information and on confirmations on actions completed (performance reporting). The confirmation on actions completed can be used as pre planning information by the other partners. The preplanning information can be used by several partners simultaneously.

The ISC-concept relies on joint planning and on joint operations for the supply chain partners. This means in practice that the partners do joint planning and the operations are carried out by the individual partners. The planning tools are agreed jointly. The individual partners do the performance reporting and the reports are analyzed jointly by all partners.

Order management (order receiving/confirmation, changes etc.) is the starting point for the ISC-concept. Planning of the distribution pipeline starts based on the order management. Order Management includes all relevant data for goods transportation and for logistics planning (time constraints, instructions for stowage and loading ex. block stowage, block train, top loading). Booking of cargo space is in some companies directly linked to the order management. Automatic vessel space booking is generated by the mills or by the logistics organizations after the confirmation of the mill order. The vessel capacity bookings are done against the agreed booking allotment. Manual vessel capacity booking can be done only if major information is missing.

Dispatch planning, is synchronized with the production planning of the mill. The dispatch planning means that the loading from the mill is planned in advance. Dispatch planning gives logistics planning impulses to the ISC-concept. Dispatching is the operational activity that

conveys the customer orders to the warehouse for releasing the items for loading and to the transport companies for picking-up (Hull, 2002, 10). Efficient synchronizing of production planning information and dispatch planning lead to more exact data for all partners in the logistics chain. This information is the core for all preplanning by all partners in the supply chain (capacity booking of trucks/wagons and estimated time of arrivals to the port).

Loading at the mill is the next process phase where information is transmitted to the other partners. The loading at the mill is normally confirmed by making a freight waybill, which confirms what has been loaded in the transport unit. The freight waybills are transmitted electronically to the cargo receiver and thus giving the cargo detailed information to the receiver.

Truck and railway transports are the fourth ISC- process (tracking services, estimates of arrival times). The transport companies deliver information, such as tracking information, to the partners who need it.

The activities of the port operator are the fifth ISC-process. The processes of the port operator have several sub processes (cargo receiving, cargo unitizing, and loading to vessel).

The activities of the shipping line are the sixth ISC- process (f. ex. vessel time schedule, cargo location in vessel = stowage plan, cargo manifest and estimated time of discharge). The shipping line is responsible for creation and updating of voyage information (schedules, cargo capacity allotment, identities, closing times etc). When the vessel has been loaded, the agent to the shipping line issues the vessel manifest. At the same time the port confirmation is generated. The port confirmation can be considered as summary of the freight waybills (on unit level) of the vessel. The physical cargo loaded on board the vessel has to be equal to the documentation. Vessel manifest and other logistics documents of the cargo must be available in port of discharge as agreed time wise, before the vessel arrival.

The activities of the port operator in port of discharge are the seventh process of the ISC-concept. These activities have normally several sub activities. (ex. vessel discharging reporting, cargo locations in warehouse). Performance reporting is given to the partners who need it.

There are five different elements, which jointly construct the Finnish paper industry's ISC-concept: 1) unit identification, 2) logistics planning, 3) transparency and 4) performance reporting 5) data communication.

The core for follow up, tracking of the cargo flow is package identity management, called unit identification. The package identity management means in practice that every time as a package is physically handled a report is generated. This report contains the package

identification, which may be a bar code or a figure string. The other levels (order line, truck, wagon, vessel) of tracking can be generated based on the package identity management by linking the package identity to the transport unit identity.

The logistics planning feature of the ISC-concept is generated from the planning and performance reporting information of the daily actions. The contents of the performance reporting vary in each of the stages in the supply chain. The performance reporting of one supply chain partners acts as planning information to the next supply chain partner. Data transmission of the performance reporting will be done automatically always when it is possible. Confirmation of a certain action generates automatically the composing of data elements and starts the data communication, to the following partner in the supply chain. The next partners in the supply chain are using the performance reporting as planning tool to new activities.

Performance reporting of one partner is the basic tool for forecasting for the next partner. Logistics planning is one of the most important elements of ISC-intelligence.

The logistics service providers of the ISC-concept give performance reporting to the other partners. Based on these reports the physical positions of the orders can be identified and this is called as supply chain transparency. A monitoring tool will be available for the ISC-concept users. Each partner can see in the supply chain where the orders are located.

The performance reporting of the ISC-concept will also be based on measurable performance criteria: The performance reporting will be used as planning tool for next actions.

The supply chain partners have software applications, which assist in planning and tracking of the logistics. When the concept development started, there were many types of interfaces and ways of working between the partners. Also the ways of data communication are different (EDI-messages, e-mail, fax and telephones).

The main functions of ISC-concept are described in the figure below. The performance reporting is shown in one of the pipelines. The planning pipeline receives performance reporting for planning purposes. The intelligence is generated from the co-operation between the performance reporting and planning. Supply chain transparency is created based on the unit identification.

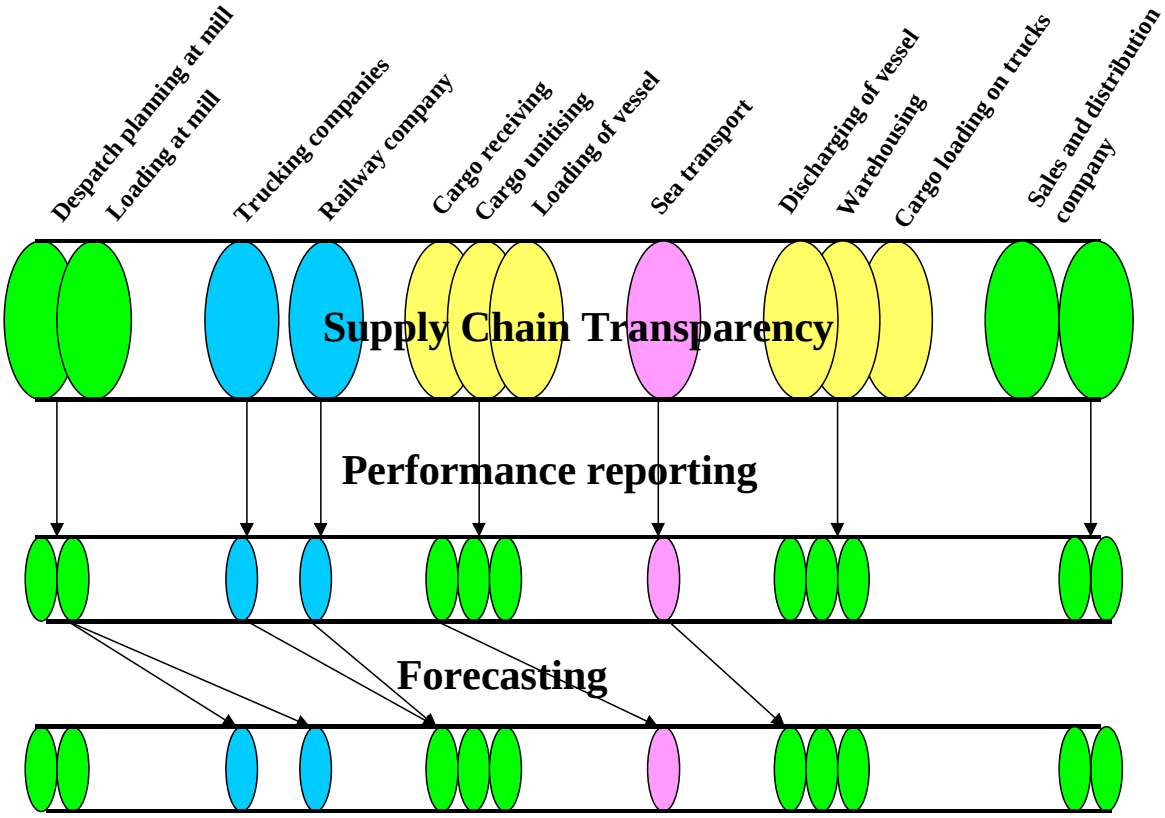

Figure 1. The main processes of paper industry's Intelligent Supply Chain

The supply chain processes and information flows of the ISC-concept including the main partners are described on a rough level in the figure below:

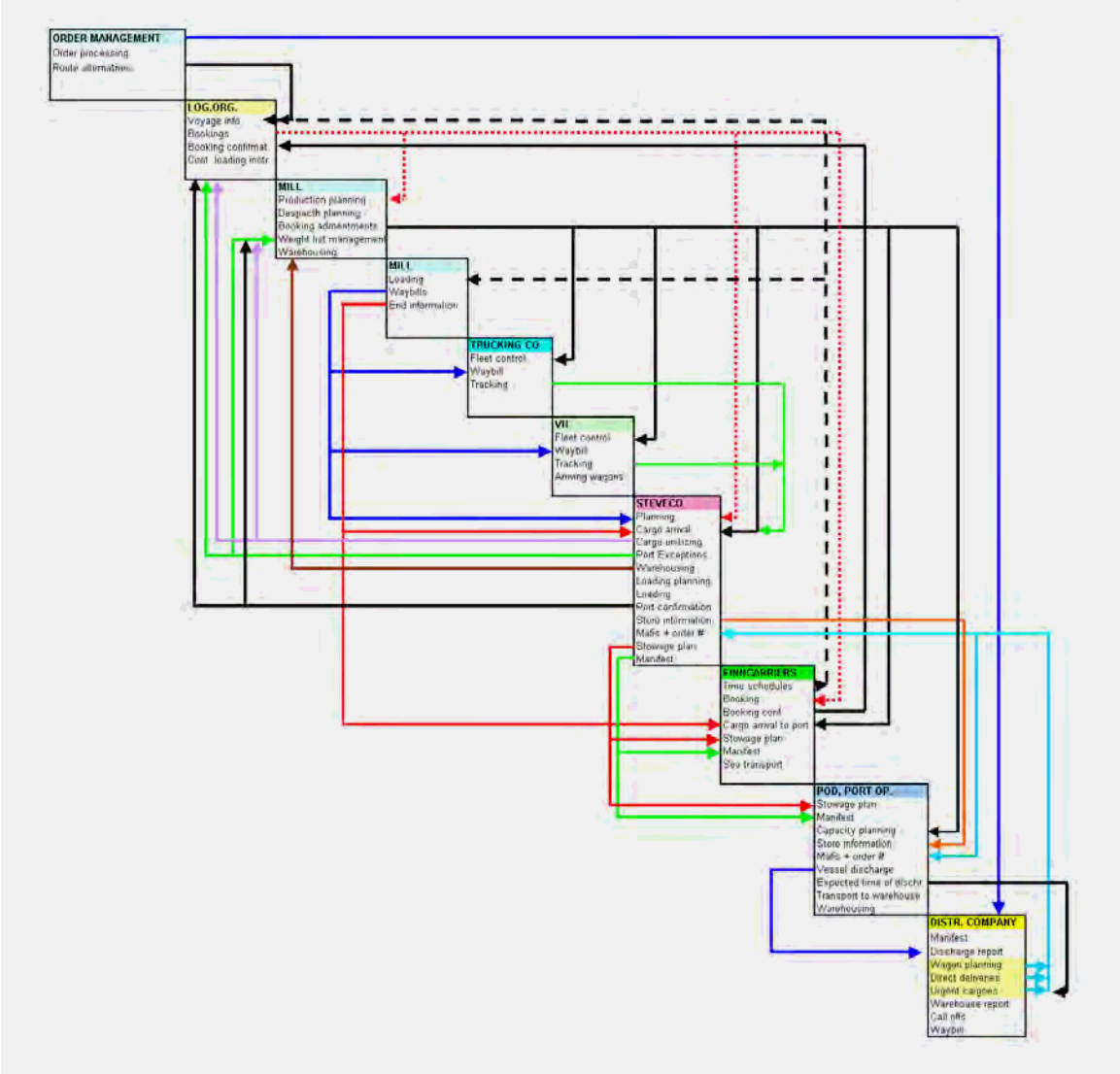

Figure 2. ISC-concept, main partners and main information flows, Source: EXPRO report, 2001

The picture above shows on a very practical level that the paper industry supply chain management is a complicated network of processes between the paper industry and the logistics service providers. Approximately 30 independent information flows are steering the supply chains from producing mill to the local warehouse at the destination markets.

5. Discussion

The Intelligent Supply Chain Concept was a good approach from the Finnish paper industry and from the logistics service providers. It was actually initiated by one of the port operators, who were suffering from daily operational disturbances due to bad planning information.

The approach itself followed commonly accepted supply chain management principles, which were then implemented locally. The ISC- concept was commonly accepted by the participating companies; however several companies informed that they are not able to follow all jointly accepted rules of the concept. There were mainly two explanations: 1) The IT-applications were under development and thus not allowing the use of commonly accepted EDI- messages. 2) Changes in the organizational structures delayed the implementation. The evaluation interviews, in 2008, showed that the implementation of the EDI-messages has been successful following jointly agreed rules. Changes in the organizational structures are unfortunately a valid argument for not implementing the ISC- concept in 2008.

There were five elements, which jointly construct the ISC- concept for the Finnish paper industry: 1) unit identification, 2) logistics planning, 3) transparency and 4) performance reporting 5) data communication.

Unit identification has been taken into use only one the paper producing companies. The two other companies do not implement in the unit identification on full scale. The company, using the unit identification, has changed the port operations to a cross docking operational model, which has lead to low warehouse usage in the Finnish ports, as all order are shipped directly to the discharging port. The unit tracking enables a totally transparent follow up of the shipped customer orders (interview, logistics manager, company B, 12th December 2008)

The source for *logistics planning* is the paper mill, where the production and dispatch planning are the starting points for logistics planning. The dispatching information should be the basis for the resource planning for the trucking companies and for the port operators. Logistics information for wagon and truck ordering is on a satisfactory level but the port operators are still suffering from reliable logistics planning information. This can be explained by the fact, that the mill IT- applications are not able to produce logistics planning information in a systematic way. The current logistics planning information is based on manual routines (interview, terminal manager, company C, 2nd December 2008).

The strategic objective for the supply chain *transparency* was providing exact information on the customer orders' location in the supply pipeline. Only one of the ISC participating companies has been able to achieve the supply chain transparency. This has been enabled by the use of unit identification, meaning that each paper reel or pallet has an identity, which is recorded to the IT applications of the paper mills and logistics service providers. These supply chain partners then transfer the unit identification and position data to the logistics application on the paper mill.

Performance reporting is understood as reporting from the logistics service providers to the paper mills. Performance reporting is at the time the source for supply chain transparency. The logistics service providers are able to provide performance reporting data to the paper industry, however only one company is able to utilize this data in a systematic way on unit level, for internal purposes such as informing the sales organization about the customer deliveries.

The most successful element of the ISC- concept is the *data communication*. All partners are currently using those EDI- messages, which were jointly agreed at the very beginning of

the concept development. EDI- based data communication for transferring logistics planning data is not yet used, but the performance reporting data is transferred electronically between the partners (interview, terminal manager, company C, 2nd December 2008).

During year 2005 one of the ISC partner companies introduced a new cargo handling solution in the loading and discharging ports. Systematic cross docking was taken into use and thus lowering the warehousing need especially in the loading port. This cargo handling technical solution could be taken into use due to the unit identification of the paper reels and pallets. At the same time the supply chain transparency reached such a level, which gave a competitive advantage tone of the companies.

6. Conclusions

The Finnish forest industry ISC-concept includes most of the supply chain management elements, which are mentioned in the literature. There was one very specific feature in the ISC- concept. It was not only developed for one specific company, but for the whole Finnish paper making industry including the logistics service providers.

The company individual commitments to the jointly agree concept were at the beginning very promising, but the reality proved to be different. There were major delays in developing the companies' IT- applications, which lead to the fact, that some companies could not implement the collaborative processes. This, on other hand, weakened the logistics service providers' interest, as they could not give same operational and commercial solutions to all paper producing companies.

The most successful element of the ISC- concept is the data transmission, which is currently used by all of the originally participating companies. Data transmission brings higher accuracy to all operations, as the data content and data elements are understood in the same manner by all companies.

The less successful elements of the ISC- concept include logistics planning information, which with the current weak quality lead to uneconomical resource planning for the logistics service providers and thus increasing the operational costs.

The collaborative strategic target was very clear for the participating companies, but the implementation has not been totally successful due to the different resources for company in-house process and IT- development. The current financial crisis, which has lead to remarkable reduction of shipped paper volumes, increases the need for uniform supply chain processes, which lead to lower costs for the industry. The basic principles of the ISC- concept are still valid. With disciplined implementation of the elements of the ISC- concept the supply chain management costs for the paper industry could be lowered and thus increasing the competiveness of Finnish paper producing companies.

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Supply chain risks and management

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Abstract
In most of the cases, supply and demand are seen independent of each others. From the company point of view, demand and supply chain are tightly interconnected. Supply chains are usually extremely complex and vulnerable to various risks. A number of these risks can be avoided by utilizing appropriate supply chain management methods. This paper is concentrating on studying the supply chain risks and their management. Supply chain model is constructed to illustrate the complexity structures and possible risks to supply chain integrity. Finally, the research helps to create a framework to evaluate the effects of these risks. This study is done as a part of a larger research project which focuses on the supply chain risks analysis in the Gulf of Finland and its immediate region.

Keywords*:* Supply chain risk, Supply chain management, Identification, Risk sources

1. Introduction

Supply chains are the linkage between supply and demand. They bind together the producer of the service or product and the customer of it. According to Waters (2007) supply chain consists of the series of activities and organizations that material move through on their journey from initial suppliers to final customers. Material includes everything that an organization moves – both tangible and intangible. Supply chains have become the center of attention in many firms for improving organizational competitiveness in the twenty-first century. Companies are now more and more exploring the potential of the concept of supply chain management (SCM) to improve their revenue growth. The chains are tuned to be more agile to get the products to customer faster at a minimum total cost (Lai et al. 2008). Highly tuned supply chains have proven however to be vulnerable to outside disturbances, and the demand for better risk recognition has become essential.

In modern world supply chains can become very long and complex. This is caused by many drivers including globalization, development of the communications and other technologies, e-business and more agile logistics. Previously supply chains were thought to be purely operational problems and on the grounds of that they were ignored and trivialized by many managers. Many recent events have however signaled how vulnerable the long and complex supply chains are. This has raised the attention of many academics and resulted as

some guidance in the form of research reports and publications. In the recent articles and books the focus has been in the need for systematical analysis of the supply chain vulnerability (Peck et al. 2003 etc). This paper is concentrating on representing a synthesized approach from the recent articles and some strategic management tools to analyze the information received from the processes and operational environment.

This study is done as a part of a larger research project which focuses on the supply chain risks analysis in the Gulf of Finland and its immediate region. As a result this paper strives to give the research a framework for risk identification and analyzing methods in their study. The most recent articles and literature has been used to attain the latest theories.

2. Defining of the concepts

To define vulnerability it is essential to form the characteristics of risk. Therefore the concept of risk is explained to have a holistic understanding of it. Thereafter vulnerability is defined. Risks are considered by variety on conceptualizations in literature. Waters (2007) defines risks as a threat that something might happen to disrupt normal activities which stop things happening as planned. The finance literature view to risks is in the terms of probabilities of expected outcomes (Beaver 1966). This point of a view is probably the oldest one known as it was used for insuring merchant ships in the hundreds of years ago. In the strategy literature risk is used to adjust rates of capital return of investment (Christensen & Montgomery 1981) variability of expected and actual returns (Bettis 1981), risk of strategic actions, and relational risks (opportunism, cheating, stealing customers etc.; Baird & Thomas 1985, Bettis & Mahajan 1985, Manuj & Mentzer 2008). Marketing sees risks as to be concerned with the nature and importance of buying goals and failure meeting psychological or performance goals (Cox 1967, Manuj & Mentzer 2008).

Many of the literature define risk as purely negative and see it leading to undesired result or consequences (Harland et al. 2003; Manuj & Mentzer 2008). A standard formula for quantitative definition of supply chain risk is:

$$Risk = P(Loss) \times I(Loss).$$

Where risk is the defined as probability (P) to loss and its significance (I).

Hetland (2003) and Diekmann, Sewester & Taher (1989) view risks as an implication of phenomenom being uncertain. The difference however is explained by Waters (2007).

According to him “the key difference is that risk has some quantifiable measure for future events, uncertainty does not”. Trkman & McCormack (2009) Classifies uncertainty into two categories, endogenous and exogenous, whether they are deriving from within or outside the supply chain.

Peck (2003) describes vulnerability as an exposure to serious disturbance, arising from risks within the supply chain as well as risks external to supply chain. According to Waters (2007) Supply chain vulnerability reflects the susceptibility of a supply chain to disruption and is a consequence of the risks to the chain. Again Jüttner (2003) describes supply chain vulnerability as the propensity of risk sources and risk drivers to outweigh risk mitigating strategies, thus causing adverse supply chain consequences and jeopardize the supply chain’s ability to effectively serve the end customer market. Supply chain vulnerability is illustrated on Figure 1.

In this paper we consider risk to be, for first, a negative by its value to the supply chain. Understanding that risks may appear in positive value and that in some studies it might be useful to take them into consideration; we see that they don’t have significance in this contemplation. Secondly, the supply chain risk is considered to comprise from any risk that concerns the material or information flow between the original supplier and end customer. These risks can arise from the organizations, from supply chain partners, or from the external environment. Risks are considered significant if they are disturbing the free flow of materials or information in a supply chain. How sensitive a supply chain is to these disturbances is measured by its vulnerability. How vulnerable a supply chain is to disturbances depends on its structural agility and resilience where supply chain (risk) management plays a crucial role.

3. Supply chain risk types

Current trend in logistics are increasing risks in supply chain (Minahan 2005). According to Singhal et al. (2009) Supply chain disruptions have become a critical issue for many companies. The categorization of the supply chain risks has many variations. In our opinion when categorizing risk one should consider them according to the supply chain in question. Some examples of the categorization are shown below.

Risks to the supply chain can come in many forms: Firstly Operational, which are considered to be minor of their consequences but occurring regularly. These risks cause disturbances in the supply chain that are not considered to be serious. However, when occurring simultaneously or when causing a snow ball effect these risks can become to have

serious affects. Secondly and more commonly considered catastrophic events are described by Zinn et al. (2009) as Low Probability-High Consequences (LP-HC) events. These events can unexpectedly disrupt the flow of material in the supply chains at any time.

Wagner & Bode (2006) uses model that uses classification where there are three risk sources: supply-side, demand-side and catastrophic. However they're classification does not cover all the risk events inherent in the supply chain, but their classification never the less brings up an way of studying the supply chain.

Tang (2006) categorizes risks to be operational or disruptive according to the nature of them. He proposes that the risks are operational when their consequences are minor but the probability of their occurrence is high. The disruptive risks are at nature occurring rarely but have high impact to the chain.

Mason-Jones & Towill (1998) and Jüttner et al. (2003) categorize the risks to three groups: Internal risks as those that arise from the organization, supply chain risks as those external to organization but within the supply chain and external risks as those external to supply chain that are arising from the environment.

Waters (2007) categorizes risks the same way, but offers options for other classification as well. One interesting way of grouping is to Physical risks that are associated with the movement and storage of the materials, financial risks that are associated with the flow of money, information risks that are associated with the systems and flow of information and organizational risks that arise from the links between members of the supply chain. The final way represented here is by Manuj and Mentzer (2008) They divide risks as shown in Table 1.

Table 1. Risk classification (Manuj & Mentzer 2008)

Type of risk	Source
Supply Risks	Disruption of supply, inventory, schedules, and technology access; price escalation; quality issues; technology uncertainty; product complexity; frequency of material design changes
Operational Risks	Breakdown of operations; inadequate manufacturing or processing capability; high levels of process variations; changes in technology; changes in operating exposure
Demand Risks	New product introductions; variations in demand (fads, seasonality, and new product introductions by competitors); chaos in the system (the Bullwhip Effect on demand distortion and amplification)
Security Risks	Information systems security; infrastructure security; freight breaches from terrorism, vandalism, crime, and sabotage
Macro Risks	Economic shifts in wage rates, interest rates, exchange rates, and prices
Policy Risks	Actions of national governments like quota restrictions or sanctions
Competitive Risks	Lack of history about competitor activities and moves
Resource Risks	Unanticipated resource requirements

Catastrophic events

Catastrophic events can be described with the help of Brindley, 2004 as follows: The probability of occurrence of catastrophic events is small but the business impact associated with such events can be extremely damaging to the supply chain. This refers to natural hazards (force majeure), socio-political instability, civil unrest, economic disruptions, and terrorist attacks (Keindorfer & Saad, 2005; Martha and Subbakrishna, 2002).

Thus, these events are so rare that they are usually not considered worth any effort. However, the consequence of such an event can be significant, and as such should be considered at some level at least by supply chain managers.

Zinn et al. (2009) propose four step planning process for proactive protection against such events: Identification of key supply chain locations and threats, estimation of probabilities and loss for each location, evaluation of alternative countermeasures for each location, and selection of countermeasures for each location.

4. Supply chain risk management

Supply chain management means a proactive relationship and integration among various tiers in the chain (Trkman et al. 2007). The supply chain view is necessary for management to be able to construct a holistic understanding about the sources of the risks. An illustration of the possible occurring events and the positioning of the supply chain vulnerability and risk management against these can be seen from Figure 1.

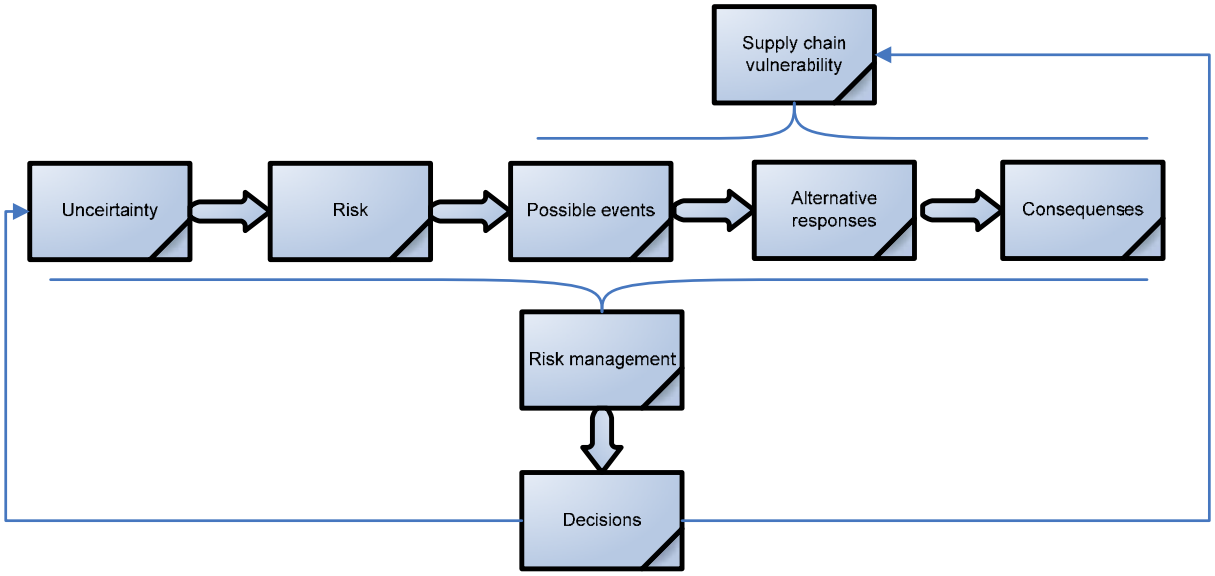

Figure 1. Relations between supply chain risk, vulnerability and management (Walters 2007).

According to Waters (2007), supply chain management is the function responsible for transport and storage of materials on their journey from original suppliers through intermediate operations, and to final customers. Hence, supply chain management controls the flow of the materials through the supply chain. Jüttner et al. (2003) defines supply chain management as: "the identification and management of risks of the supply chain, through a coordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole." Supply chain risk management aims to identify the potential sources of risk and implement appropriate actions to avoid or contain supply chain vulnerability. It is needles to say that supply chain management and supply chain risk management (SCRM) have an important role.

SCRM can be viewed as a strategic management activity in companies given that it can affect operational, market and financial performance of firms (Narasimhan & Talluri, 2009). Key concepts in SCRM are the source of risk, magnitude of risk and its relationship to business objectives, and threat of disruption in supply chains. Framework for risk management in the supply chain is presented in Figure 2. Further studying of this framework is presented in the following chapter.

Figure 2. Supply chain risks management framework**.**

5. Identifying supply chain risk

Identifying supply chain risks is a key activity that forms the foundation for all other aspects of supply chain risk management (SCRM). In reality it is virtually impossible to list every conceivable risk, and identification gives a list of the most significant risks that have an affect to the supply chain. Inter-organizational people have usually the most intimate knowledge of the organization and its conditions, but not necessarily the capability to identify risks. Organizations can not rely on personal knowledge and informal procedures, but need some formal arrangements to identify risks (Waters 2007). In order to manage something, one must have a holistic understanding of it. Finding out the supply chain structure is therefore imperative. This is the case also in identifying the risk involved. Operations of the chain must be mapped clearly in order to see what risks are involved in those. Figure 3 illustrates an exemplarily supply chain.

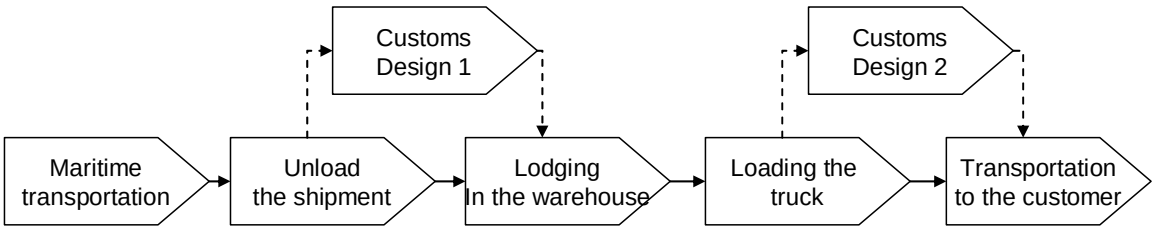

Figure 3. Example of supply chain structure

For risk identification in the supply chain are several tools available (see e.g. Peck et al, 2003). In our research for we have selected Failure Mode and Effects Analysis (FMEA) as a tool for risk identification and analysis. FMEA is a proactive tool developed to identify, evaluate and prevent product and/or process failures. The conventional FMEA procedure suffers from inadequate definitions for some steps, high uncertainty, and even decision making failures throughout the procedure (Bluvband & Grabov, 2009).

The effectiveness of an FMEA can be significantly improved by identifying potential pitfalls, and raising awareness of potential problems. Applying a strategy that utilizes controls

and rules can efficiently mitigate, or even avoid, all known possible harmful effects. This article proposes proven solutions that support the entire end-to-end FMEA sequence of activities (from the point of initiation of the analysis - Failure Modes identification – up to its culmination – evaluation of the effectiveness of the procedure), and the remedies proposed, in reducing risk (Bluvband & Grabov, 2009).

Table 2. Example FMEA worksheet for risk identification in the supply chain

Supply chain step	Potential failure mode	Potential failure effects	Potential causes
Maritime transportation	Ship sunks	Product lost	High waves caused by climate change
Unload the shipment	Product dropped while unloading	Product broken	Poor skills of the employees, condition of the unloading equipment
Lodging In the warehouse	Product lodged in wrong place	Shipment late	Poor organization of the warehouse
Loading the truck	Product tied up wrong	Product damaged	Haste, Inadequate instructions
Transportation to the customer	Truck drivers strike	Product late	Labour unions conflict with employers
Unloading at customer	Product dropped from forklift	Product damaged	Poor handling equipment and training

Simplified FMEA worksheet for risk identification in the supply chain is illustrated in Table 2. The FMEA tool provides a systematic framework for breaking the supply chain into its parts, and further investigating the risks of each part. The initial root-causes of the risks can be identified when the causes of risks are explored. This will facilitate in risk likelihood assessment. Failure effects are, on the other hand, important information sources for risk impact evaluation (Dallas 2006).

6. Managing supply chain risk

When trying to mitigate the risks affecting supply chain it is also important to understand where the risks derive from and find their sources. Therefore contingencies can by built to prevent the effects or the realization of the risks. Jüttner et al. (2003) categorizes risk sources into three different groups: Environmental risk sources, network-related risk sources and organizational risk sources.

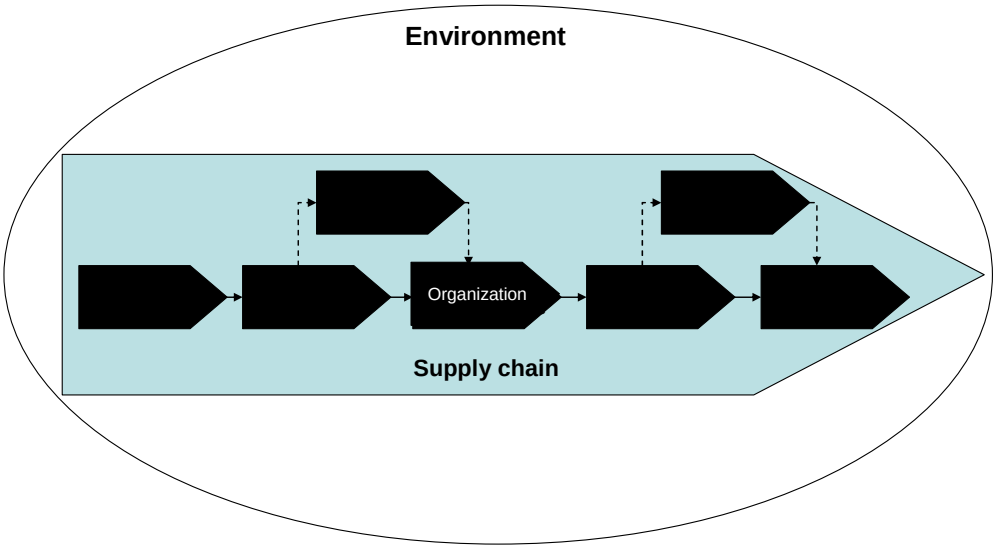

Figure 4. Risk sources in supply chain (Jüttner et al. 2003)

The aim of designing a response to supply chain risks is to define to most appropriate way of dealing with all risk to the supply chain; after the risks have bee identified and analyzed with prioritization that shows that amount attention that each risk deserves the amount of resources sacrificed to handle those should be carefully considered.

Waters (2007) suggests the following range of different responses to risks

1. Ignore or accept the risk
2. Reduce probability of the risk
3. Reduce or limit the consequences
4. Transfer, share or deflect the risk
5. Make contingency plans
6. Adapt to it

7. Oppose a change
8. Move to another environment

7. Conclusions

In this paper we have gathered the essential articles and literature to synthesize understanding for the concept of risk and to suggest the process for supply chain management aid to handle risks. The aim was to provide information for STOCA research project.

The main objective was to create a framework for supply chain risk management. The academics have been diligent in providing literature for supply chain risk management. There is a vast variations of theories provided where risk are considered in many forms.

The key was to create a clear concept from it. After that the risk management process is started by identifying risks that appear in the supply chain. In order to do that, management must understand the structure of the supply chain. In order to identify the risk modes we suggest that the use of Failure Mode Envelopment Analysis. With this also the analysis of the risk can be done to some level.

Complete understanding of the consequences of the risk is impossible to analyze. However, in order to prepare and prevent them from happening it is important to understand from which level the risk derive from. The source of the risks can be classified to three levels: From the environment in which the supply chain operates, inside the supply chain and inside the organization operating in the supply chain.

The management of the risk can be done with different responses. The understanding of the risk and their consequences plays an important role in the light of designing these responses. The level in which the risks are mitigated should be planned according to their impact.

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The rise of competition in Finland's rail transport

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Abstract
The domestic rail freight transport has been opened to competition as from 1st of January 2007 in Europe as well as in Finland. The markets are shown only limited change, and the market share of the incumbent railway companies remains high. In Finland, there have not been entrants to the rail freight transport market in the first two years after deregulation. The market entry barriers are significant, which reduces the attractiveness of the Finland's rail freight transport market. In Finland's market, the biggest market entry barriers consist of rolling stock acquisition, accessing to the services, administrative factors, and recruiting skilled personnel. Eventually the empty disco effect will come to an end, as the first railway undertakings enter the market and the intra-branch competition begins. It is anticipated that Finland's basic manufacturing industry puts the biggest transport flows out to tender. The first actor is expected to be forest industry, and it shall start a tendering with raw wood transports continued with product transports. It is also expected that the metal industry and chemical industry will follow soon with the tendering process. The competition will change the market: the price-level is to decrease and railway undertakings' service quality and efficiency is to rise.

Keywords: Rail transport, competition, competitive tendering, market change, entry barriers

1. Introduction

The European Union transport policy aims to develop an economically, socially and environmentally sustainable transport system, which requires a change in the balance between transport modes by transferring road freight transport and its growth to more environmental-friendly modes, such as inland waterways, short-sea shipping, and rail transport. This is a challenge for railways, as it has been – according to the European Commission – in a state of "decline". There are reasons such as lack of infrastructure, poor interoperability and incompatibility, unreliable services and weak productivity, which have been seen as a drag on growth and development on railways and rail transports. The Commission sees that opening the rail freight transport market to competition is an obligatory precondition for boosting rail transport and creating more competitive rail freight transport market. (European Commission, 2001; European Commission, 2006; European Commission, 2008; see also Oum et al., 1999; Mäkitalo, 2007.)

The European Union has imposed railway legislation and has deregulated step-by-step rail transport towards a free market and competition. The start of the legislation was the rail development directive given in 1991. In the Union international rail freight transport was deregulated and opened to competition in 2003 in compliance with the first European Union's

railway package. A union law-making package refers to collection to simultaneous-given legislation, which may consist of directives, regulations and communication papers. A directive is indicative and steering legislation, which needs to be implemented to the national legislation. In contrast to a directive, a community regulation does not need national legislation, as it is by itself in force in the European Union. The first railway package opened competition in international freight transport. The package set also rules for rail capacity allocation procedure and for handling of safety certificate and operating licence. It was the second railway package, which opened domestic rail freight transport to competition in the beginning of 2007. The package contained also legislation in safety and interoperability. (Directive 2001/14/EC; Railway Act 555/2006; Mäkitalo, 2007.)

Even though competition has been open and it has been possible to enter the market, the markets in Europe have changed slowly. Particularly Sweden and United Kingdom have been active in creating efficiency to railway sector by re-organising. Sweden has re-organised the whole railway sector already in 1988 and begun with opening competition. Despite of the actions, the combined market shares of new railway undertakings are plummeting and markets are changing very slowly (See e.g. Nash, 2008; Hilmola et al., 2007; Nilsson, 2002; Cowie, 2009.). Likewise in Finland, the domestic rail freight transport market has not attracted new railway undertakings in 2.5 years of open competition.

As said, the European Union's transport policy aims to increase the competitiveness of rail transport by facilitating intra-branch competition. The situation is unsatisfactory, and the railway sector performance remains approximately stable, as the open market does not attract newcomers and the competition do not bring the needed changes. The purpose of this paper is to estimate how the rail freight transport market change as the market has been opened to competition. This research seeks answers to the following questions:

- Is the market entry a realistic possibility in Finland's rail freight transport market?
- How Finnish industry takes a view of rail transport competition?
- What amount of competition is expected in rail transport?

In this research, two research methods were used. As there is only one railway undertaking – the incumbent – in the rail freight transport market in Finland, the research material could not have been based on actual experiences. Thus the expectations of the rail freight market future were collected by the Delphi technique. Also, research material was collected by semi-structured interviews on rail freight service customers, i.e. Finnish industry.

The paper structure is following: The next chapter describes market entry and market entry barriers in rail freight transport market. As well in the chapter, the rail freight transport

market entry phases are described. The Chapter illustrates also previous studies on market entry barriers. In the following chapter, the used research methods are described in detail. After that, research analysis and results are described. The last chapter reviews and discusses the results. The chapter suggests also a couple of topics for further research.

2. Market entry and its barriers in rail freight transport market

The market entry of a new railway undertaking starts with applying for a safety certificate and an operating licence. The safety certificate makes sure that the railway undertaking practices corresponds to the safety standards and criteria needed and regulated in railway operations. In Finland, the certificate is granted by the Finnish Rail Agency. The safety certificate makes out that the operator has for example a detailed safety management system and competent personnel and management. For railway undertakings operating in another European Economic Area country or countries, the Finnish Rail Agency just approves the safety certificate, which has been granted in other country. For operators based in Finland, the operating licence is granted by the Ministry of Transport and Communications Finland. The licence is valid in the whole European Economic Area. In the licence-issuing process, it is checked that the operator has for example solid financial standing and management with required competence and a good reputation. (Railway Act 555/2006; Finnish Rail Agency, 2007; Finnish Rail Administration 2008.)

The railway undertaking may apply for rail network capacity after it has the safety certificate and the operating licence. Capacity is requested from the Finnish Rail Administration, which is the infrastructure manager. Capacity is allocated for one-year-long timetable period and on shorter terms. The Rail Administration grants capacity based on the applied capacity, and if needed it co-ordinates the timetable needs of the capacity applications. The last step in the market entry before starting the rail transport operations is access contract between railway undertaking and the Rail Administration. The access contract describes rail network usage rules and principles and the use of services provided by the infrastructure manager. The access contract is made for every timetable period. (Directive 2001/14/EC; Railway Act 555/2006; Finnish Rail Administration 2008.)

An entrant do not have to have rolling stock and personnel before starting the application process of the safety certificate and the operating licence application, and therefore needed railway stock acquisition and personnel recruitment can be made simultaneously with the process. However, the entrant must be able to give sufficient information how it is going to

proceed with the aforementioned matters. (Directive 2001/14/EC; Finnish Rail Administration, 2008.)

Previous studies have identified following elements as market entry barriers: railway stock acquisition and poor market feasibility of railway stock market, market influence of incumbents, getting skilled personnel, access to incumbent's service and maintenance facilities. Market entry barriers may vary to some expend from country to country as business environments change. (Bergdahl, 2005; Nash & Preston, 1992; Nordenlöw & Alexandersson 1999; Alexandersson & Hultén, 2005; Iikkanen, 2007; Pfund 2002; Swedish Rail Agency, 2007.) Mäkitalo (2007) has suggested that market entry barriers could be seen through three dimensions: financial, technical, and administrative. In European countries market entry barriers are great, however entering the vertically integrated transport market of the United States of America is much more difficult (Hilmola & Szekely 2006; Hilmola et al., 2007). In economics theories and in market competition, barriers to market entry are in crucial role, for the being of those barriers mean that competition is imperfect and that it is possible for companies to behave in a non-competitive manner. (Mankiw, 2004; Kurokallio, 1990.)

3. Research methods

This paper's research material consists of research material data for two earlier studies (Mäkitalo 2007; Iikkanen 2007). For the paper in hand, the mentioned research material data was re-analysed and cross-checked. The first research material was collected by the Delfoi technique in 2005, and the latter was collected by semi-structured interviews in 2006.

The Delphi technique is a futures research expert view data collecting method. The method is at its best when assessing future possibilities and particularly when the research deals with an indefinable issues. For long time it was common that the technique was a method for creating a consensus among the expert panel, now the focus is more on argument logics and coverage. Anonymity is an essential feature of the technique. However, expert names and organisations are often revealed for the respondents, but the source of opinions and arguments are kept in secret. (Kuusi, 1999; Turoff, 1975.) The research material data is collected by using consecutive question rounds. The latter rounds focus on certain themes, which are raised for interesting issues. It is also possible to show feedback and given arguments on earlier question rounds. (Kuusi, 1999; Linstone, 1978.)

In the study, the expert panel consisted of a bit more than 50 people. The panel covered all the interest groups, such as Finnish manufacturing industry, Ministry of Transport and Communications Finland, the Finnish Competition Authority, the Finnish Rail Agency, the Finnish Rail Administration, the incumbent company VR Ltd (former Finnish State Railways) and labour organisations. The data collection goal was to get data on rail freight market entry and issues related to that. The data was collected in 2005 by two questionnaire rounds. On both rounds, the questionnaire was sent with a cover letter with an envelope to return the answer, and a list of the expert panel. The response rate was on the first round 77 per cent and 45 per cent on the second round.

A semi-structured interview method is settled in between of an open interview and a form or questionnaire interview. A semi-structured interview allows more freedom than structured interview, as the researcher may deepen the discussion on certain themes. However, the interview method has a certain basic structure, which sets the interviews to same outlines. (Hirsjärvi & Hurme 2001; see also Merton et al., 1956.)

In the latter of the two mentioned studies, thirteen people were interviewed. The interviewees were chosen from the Finnish basic manufacturing industry companies, which use rail freight transports. And therefore naturally the biggest rail transport customers were included. The data collection goal was to acquire information on companies' expectations on market change and their willingness to proceed with competitive tendering. The interviews were made in 2006.

4. Analysis and results

In Finland, the domestic rail freight transport market has been open for competition for more than two years, and the incumbent railway undertaking VR Ltd is still the only player in the market, and it seems that the competition is open only in paper. Even though there is not intra-branch competition, the Finnish basic manufacturing industry is keen on competition. Especially the forest industry awaits the competition. Naturally the interest in competition varies from branch to branch and in the level of single companies. Some companies remain idle and follow the progress, while some are active in the opening of the rail freight transport market. Active companies have e.g. looked for new railway undertaking, made calculations of traffic operations costs, and made efforts in clarifying market entry and competition issues.

According to the research, the Finnish basic manufacturing industry is going to make competitive tendering on their biggest rail freight transport flows, when there are new railway

undertakings on the market. For the industry, the biggest cost-saving potential is naturally in the big transport volumes, where the traffic operations and rolling stock circulation are efficient. The industry is looking for its competitiveness and cost-savings, but according to the research the industry is not willing to lower the need of reliability. It seems that the entrant has to offer the needed level of quality and a remarkable discount compared to incumbent's prices, as was the case in Sweden (Alexandersson et al., 2000).

Besides the mentioned need for reliability, the industry is not interested in competition itself, but the on the effects of the competition. It is clear that the industry is not aiming to maximise the market share of new railway companies, but already a couple of new players and credible competition which enables the power to make competitive tendering. It is expected that competition change the market: the price-level is to decrease and railway undertakings' service quality and efficiency is to rise.

This research implies that the rail freight transport prices are going to decrease due to competition, and even due to threat of competition. The industry expects that the threat of competition may lower prices by ten per cent or a bit more. In the actual competitive tendering, the price-cutting desire is higher, from ten to thirty, thirty five per cent. The average presumption is around twenty per cent. According to the research, the price-cut anticipation is stronger in larger transport volumes and in the forest industry. It seems obvious that before there is real competition, the industry makes short transport service contracts.

As rail transport price-level decreases, naturally it would be expected that lower prices attract new freight transports according to the supply and demand curves. More transports with lower price-level would mean that the productivity and the competitiveness of the Finland's rail transports would increase. (see e.g. Mäkitalo, 2007; Oum et al., 1999; Hilmola et al., 2007). This means that rail transports would grow basically on the expense of road transports. However, transport service prices reflect also the competition situation between transport modes. In Finland, the average length of rail freight transport is 230 kilometres, and the lower prices would mean that rail transport should be an option even on shorter distances. (See also Conrad, 2000; Iikkanen, 2007)

The research estimates that the Finnish forest industry is first to launch the competitive tendering. The forest industry starts tendering with raw wood transports and continues with the biggest product transports. After forest industry's moves, it is expected that the metal industry follow soon with its raw material and product transports competitive tendering process. In the metal industry rail freight transport, customised rolling stock plays an important role and rail freight transport customers are bounded to the service provider for a

long time, and therefore the competitive tendering is connected to renewal of the rolling stock. The high investment costs to the specialised metal transport rolling stock reduce the attractiveness of these transports, even though the metal industry would be interested in competition. Also chemical industry will follow the footsteps of the forest industry.

These competitive tenderings mean that it is foreseen that – even although the incumbent is able to keep many of the transports – new railway undertakings enter the market. At most, the market share of new railway undertakings is around twenty per cent in 2015. This means that the market would change slowly, which has been the case e.g. in Sweden (see Alexandersson & Hultén, 2005; Bergdahl, 2005; Swedish Rail Agency, 2007).

5. Conclusions

This paper suggests that the Finnish rail freight transport market shall change, and new railway undertakings enter the market. The price-level is expected to decrease dramatically, which attract more rail freight transports. This would naturally mean that the entry to the market is possible, even though market entry barriers in Finland are outstandingly high. According to the research, the basic manufacturing industry puts the biggest transport flows out to tender. The forest industry is expected to be the first actor when competition realises, and metal and chemical industries are to follow.

As the paper describes, rail freight competition creates a more efficient rail transports in Finland, and therefore it would be important to boost competition in transport policy. However, besides railway undertaking related financial and technical barriers, the administrational elements of market entry form a significant challenge, like Mäkitalo (2007) has illustrated. Therefore transport policy should oblige governmental authorities to create a level playing field and a neutral market structure.

This paper raises a couple of interesting research topics for further research. It would be valuable to study and to analyse deeper why rail freight transport market changes so slowly. And on the other hand, the market dynamics and the market forces would be a multidimensional research issue. Especially, it would be worthy to carry out research on market change actions and dynamics. Also, it could be interesting to study price elasticity regarding to demand changes in rail and road transports.

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Timetable-based rail network investment strategy

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Abstract
Rail network development faces multidimensional challenges in networks, which consist mostly from single-track lines. In these networks, the traditional development tactics is capacity bottleneck analysis and theoretical timetable saving calculation. Medium and long-term evaluation may reveal, that timetables have changed and the rail infrastructure investment that has been made is not needed anymore and the investment has been made for unnecessary purposes. The timetable-based rail network investment strategy is a method to allocate limited investment resources to maximise results. Regular interval timetable system is a passenger transport timetable structure with regular and symmetrical traffic services. Railway stations form a connection-hub-system, which serves customers well. The regular service means also that the need of rail capacity, i.e. rail infrastructure, remains the same from day to day. The network development examination is different when the demand is constant. This makes it possible to direct limited resources to the most important targets. The paper suggests that in single-track dominated networks, the timetable-based rail network investment strategy is a great opportunity for better productivity.

Keywords: Rail infrastructure, rail transport, timetable, investment

1. Introduction

Railway sector is changing from a state railways' era to a fragmented and multi-actor environments, particularly in Europe, as transport operations and rail network management have been vertically separated. Rail transport competition has boosted the change of the sector. (Mäkitalo, 2007; European Commission, 2001; European Commission, 2006; see also Hilmola et al., 2007; Alexandersson & Hultén, 2005.) Rail network development and infrastructure management face new challenges, not only because of the lack of funds, but in allocating resources in a way that the result is effective and neutral from railway undertakings' point of view. (Finnish Rail Administration, 2006; Mäkitalo, 2007.)

Rail network development faces multidimensional challenges in networks, which consist mostly from single-track lines. For example, in Finland, the network is single-track for 90 per cent. In these kinds of networks, the traditional development tactics is capacity bottleneck analysis and theoretical timetable saving calculation. Medium and long-term investment and rail network usage evaluation may reveal, that over time train timetables have changed and the rail infrastructure investment that has been made is not needed anymore and the capacity enhancement has been made for unnecessary purposes. (Kanacilo & Verbraeck, 2006; Finnish

Rail Administration, 2006; Finnish Rail Administration, 2008; Mäkitalo, 2000; Swedish Rail Administration, 2007.)

The paper aims to be a conceptual review and theoretical description. The purpose of this paper is to introduce the basics of a timetable system called as the regular interval timetable and to describe how the system enables a new kind of perspective to infrastructure development. The aim is also to describe the timetable-based rail network investment strategy, and show with an example how it works. This research seeks answers to the following questions:

- Is it possible to develop rail network based on train timetables?
- How investments could be targeted to a network?

The paper has the following structure: The next chapter introduces the regular interval timetable system and describes its features. It is important to know the basics of the regular interval timetable system in order to understand how to carry out targeted rail network investments. In the following chapter, the timetable-based rail infrastructure development method, the targeted investment, is described. After that, an example of targeted investment on Tampere–Jyväskylä section, Finland, is given to demonstrate how the idea works in practise. The last chapter reviews and summarises results and presents conclusions. The chapter suggests also a couple of topics for further research.

2. Regular interval timetable

The regular interval timetable (in German Taktfahrplan, in Finnish vakioaikataulu) is a rail transport timetable system in which traffic is frequent and symmetric. The timetable system was first introduced and taken into use in Switzerland in early 1980's. As such a certain type of constant timetable structure was used in Germany as early as in 1940's. (Pellandini 2000; Latscha, 1982; von Stähli, 1990; Schulz, 1994.) The timetable system is basically and originally for passenger transport, but it is applicable as well in rail freight transport (see e.g. Iikkanen et al., 2005). In the regular interval timetable system, trains' departure and arrival minutes are constant and traffic operations are identical from hour to hour. (Johnson et al. 2006; Pellandini, 2000; Mäkitalo, 2001.)

In the regular interval timetable system, trains arrive to a hub station a few minutes before an hour, and they leave the station a few minutes after the hour. This means that trains from different directions are at the station at the same time, at the hour, which makes it easy to

change from train to train. And therefore the regular interval timetable system creates for a passenger a network with connection options, and it creates added value for passengers by better travel chains and with easily rememberable customer timetables. (Johnson et al. 2006; Pellandini, 2000.)

Rail network's distances are examined by time, i.e. as minutes, and not by length, i.e. as kilometres, when applying the regular interval timetable system. A network of hub stations is searched in order to create system with multiple train connections. To the opposite directions running trains meet at every half of the frequency, i.e. with e.g. one-hour frequency, these trains meet every half an hour. And whenever possible, these meetings are planned to happen in stations with commercial timetable stops. This of course means that the train's running time between hub stations is at its best a multiple of a half of the frequency. It means that for e.g. with a two hour frequency, the hub stations may be one hour apart. The basis of the regular interval timetable system is that timetables are planned and trains operate as fast as necessary, not as fast as possible. (Mäkitalo, 2001; Pellandini, 2001.)

3. Regular interval timetable and targeted investment

The traditional way of developing rail network is on the basis of current traffic and estimated foreseen traffic progress needs. After a rail network investment is made and rail capacity is increased or a capacity bottleneck problem is solved, the faster train travel times are taken into account in the next customer timetables as much as possible. Due to its constant structure, the regular interval timetable system enables an opportunity to carry out reversed timetable planning. First of all, it is considered what kind of traffic and transport services are ideal or worth to seek for. After this it is analysed, how the defined train traffic timetable could be realised. This makes it possible to see what kind of development need there is for rail network infrastructure and/or to rolling stock. (Stohler, 1993; Mäkitalo, 2001.)

The regular interval timetable system enables to allocate resources, i.e. target investments, and it also illustrates rail sections on the network, which do not need capacity investment from the perspective of the regular interval timetable. In the planning phase of the timetable system area coverage, rail sections may or may not fit to the system. Those sections that fit to the system are directly applicable for the system, and those do not need investments, at least from the timetable system's point of view. Those sections not fitting, i.e. the section's travel time is not applicable into the regular interval timetable system, may be fixed by investing to

the rail section or to rolling stock, or adjusting the role of the hub stations. (Stohler, 1993; Mäkitalo, 2001.)

4. Targeted investment case: Tampere–Jyväskylä

In Finland, Tampere–Jyväskylä rail network section has been a good example (see e.g. Mäkitalo, 2001) of targeted investment, as the section had many investment scenarios. And it was not solved until the regular interval timetable system and targeted investment fixed the capacity increase and investment issue. In the original state in 2004, Tampere–Jyväskylä section was double track from Tampere to Orivesi, and the rest of the section was with one track, the Figure 1 illustrates the Tampere–Jyväskylä section. In the Figure, travel times between stations and passenger train meetings are shown.

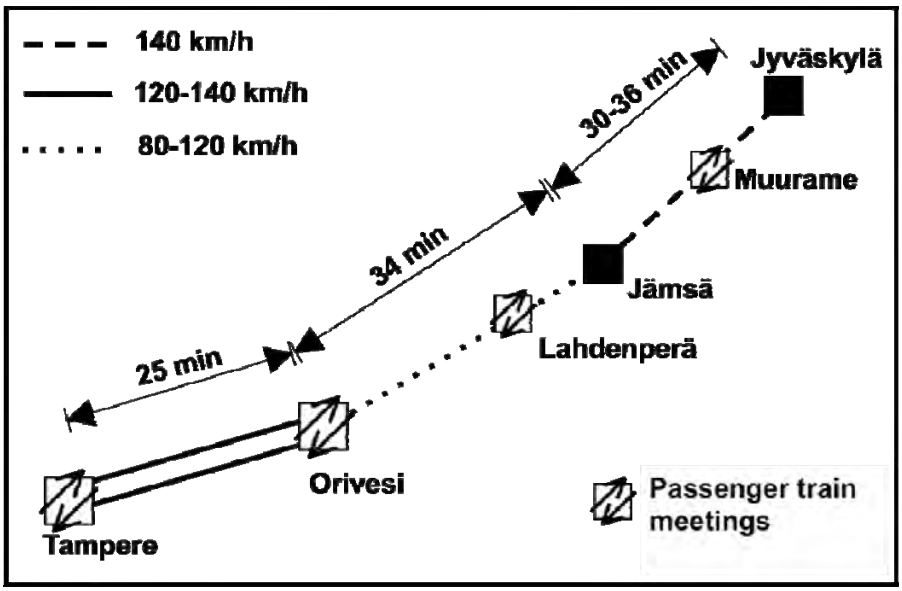

Figure 1. The original passenger traffic on Tampere–Jyväskylä section.

With a one-track network and rail sections, a general aim, and especially with the regular interval timetable system, is plan train timetables in a way that train meetings are on stations, which are commercial stops. A train meeting somewhere else mean that the stopping train loses at least five to ten minutes. According to the idea of the regular interval timetable system described earlier, the aim on the Tampere–Jyväskylä sections is that the train meetings from Lahdenperä and Muurame (Figure 1) are moved to stations Jämsä and Jyväskylä. Then

and in the objective state, the Tampere–Jyväskylä rail section would be as illustrated in Figure 2.

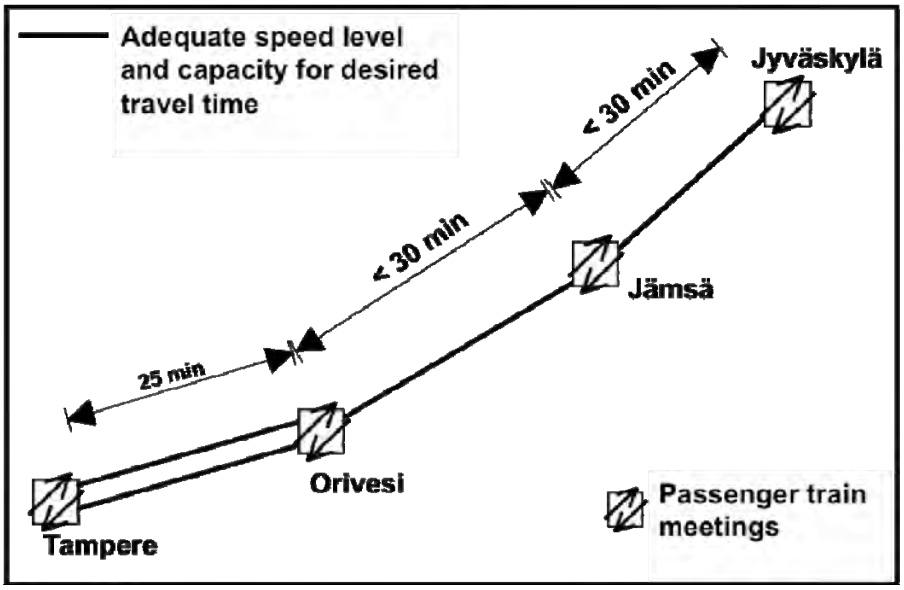

Figure 2. The objective of passenger traffic on Tampere–Jyväskylä section.

Tampere is a central station and connection hub in Finland, and therefore it is one of the most important nodes in the regular interval timetable system. For the whole journey of Tampere–Jyväskylä it is strived a travel time a bit less that 1½ hours. When comparing travel times between the original and the objective traffic states, it is found out that the capacity and the regular interval timetable system applying problem is in the section of Orivesi–Jämsä.

The described problem could be solved, as introduced earlier by 1) an infrastructure investment, 2) a rolling stock investment, and 3) a timetable and service change. The third option would mean for example cutting down the service level or by leaving at least one commercial timetable stop out between Tampere and Jyväskylä; both of these would be difficult for many reasons. What comes to the second option, the Orivesi–Jämsä section is very curvy, and as tilting trains may run faster in the section, it would be possible to solve the capacity problem by investing to tilting trains – in Finland to Pendolinos – for that rail network section. Pendolinos are able to run the rail section in 29 minutes, which would be enough for the regular interval timetable system.

For the first option, an infrastructure investment, there have been several alternatives and scenarios on hand to increase rail capacity. Former rail network development strategies have named some heavy investment possibilities for infrastructure investment needs (Finnish Rail Administration, 1998). However, as described in earlier chapter, the regular interval timetable

system indicates which rail sections do not need investments and which section needs an investment giving a certain amount of train running-time saving. The aim on the Orivesi–Jämsä section would be that trains are able to run the section in less than 30 minutes with as small investment as possible. The capacity problem could be solved by investing to a double track section, which could be situated from timetable's point of view either to Orivesi or to Jämsä. The double track section should be five kilometres in length. If the section would be in Orivesi, a timetable solution would be such that train meetings would be after Tampere on double track section after Orivesi, in Jämsä and in Jyväskylä.

The described targeted investment would enable a time-saving of five to ten minutes for all the trains in Tampere–Jyväskylä section. The saving is gained, as the train meeting would move to stations, where there are commercial stops as well. It is also notable that passenger trains running in timetable do not need sidings on the section, and therefore the targeted investment, planned basically on the needs of passenger transport, would benefit also rail freight transport.

5. Conclusions

The regular interval timetable system is excellent for passengers, as it is easy to remember by heart. The system also creates a hub-network with connections, like in air transport's hub-and-spoke system (Mäkitalo, 2001; see also Givoni, 2007). Also the rail transport system may be connected better to other transport modes, as trains are at hub stations at an hour. Besides, as the traffic is repeated identically from hour to hour, it is handled better by traffic control, and easier and more convenient to create operations models for disturbances. This means that compared to non-system timetables but with likewise timetable planning principles, the regular interval timetable system has more potential to have better quality and punctuality.

As the regular interval timetable system's service improvement is undeniable for railway undertakings' customers. Competition in passenger rail transport may pose a threat to the timetable system, as railway undertakings plan their timetables and apply capacity for that. It is a minor threat that new railway undertakings would not see advantages of the system and would abandon it. But the major threat is that infrastructure managers do not see the timetable system's value, when they are allocating capacity.

The timetable system's frequency makes it possible to develop rail network on the basis of train timetables. As the targeted investment method allocates resources to the most needed destinations, rail network management becomes more productive, and therefore the timetable-based rail network investment strategy is a golden opportunity for rail administrations. However, targeted investments made according to the regular interval timetable system do not necessarily look especially good in cost-benefit analyses, as analyses focus only to the investment section, even though they could play an essential role in rail transport system development.

This paper raises a couple of research issues for further research. It would be worthwhile to study economic implications of targeted investments made according to the regular interval timetable. This kind of study would give valuable information to cost-benefit analyses and to analyse method development. Also, the regular interval timetable system application in rail freight transport and in the whole rail transport system would be valuable, as both passenger and freight trains are using the same network.

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Swedish and Polish railway freight operators' market entry

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Abstract
Sweden liberalized the railway freight market in 1990's, Poland followed in 2000. After decades of the monopolistic market, both nations have enhanced competitive forces. Today Swedish railway freight market has 17 active players and Poland 49. Although, number of operators has increased, effects on the competition has been questioned due to niche operators.

Research revealed both discrepancies and similarities between the countries. The findings support earlier studies: main market entry barriers are exogenous by nature; needed investments, rolling stock (especially locomotives) and bureaucracy. Interestingly, same factors were stated in both case countries, although order varied. In several cases Swedish railway undertakings have background from governmental company (Swedish State Railway, Statens Järnvägar, SJ), but in Poland companies have been established on the grounds of heavy industry. However, both markets are growing, which enables new opportunities for railway undertakings.

Keywords: Barrier to entry, liberalization, market entry strategy, Poland, railway undertaking, Sweden

1. Introduction

Railway freight markets' deregulation has been researched in several studies (see for example Brewer 1996; De Jorge & Suarez 2003; Hilmola et al. 2007; Jensen & Stelling 2007; Ludvigsen & Osland 2009; Mäkitalo 2007; Profillidis 2004). However, the studies have mainly scrutinized the railway freight liberalization pioneers, for example UK (Brewer 1996; Woodburn 2003; Woodburn 2007) and US (Boyer 1987; Jahanshahi 1998; OECD 2005). Numerous studies have concentrated on comparing western countries, like UK, Sweden, Germany and US (see for example Hilmola et al. 2007; Ludvigsen & Osland 2009; Profillidis 2004) or eastern countries (Szekely 2009). However, a clear gap exists in comparing western and eastern countries. Few studies have opened the path; Szekely & Hilmola (2007) analyzed Swiss, Japanese, Polish and Hungarian railways. Existing literature mainly builds on second-hand statistics and literature analyses, concentrated on researching the influences on the country level. Therefore, there is a lack of studies utilizing first-hand data. This research attempted to fulfil the gap. On the basis of 13 interviews with railway freight operators in Sweden and Poland, actor level information is concluded. Previous second-hand data and literature analyses are compared with the research's result, in order to compare how literature analyses and first-hand data correlate.

This article describes the barriers to entry confronted by the Polish and Swedish railway freight operators after the liberalization. Railway freight industry confronts remarkable market entry barriers due to high fixed costs and bureaucracy. Article describes the barriers and discusses the differences. In addition, market entry strategies utilized by the private operators are presented, and brief comparison between case countries is provided.

2. Literature review

Markets confront various barriers to entry, varying depending on the market's structure, industry and amount of players. Therefore, it is essential to understand the market entry barriers, which may complicate the entry process. Topic's theoretical dissection started in 1950's, when Bain published "Barriers to New Competition", which is seen as a pioneer piece of the theory (Baron 1973; McAfee et al. 2004; Pehrsson 2009; Schmalensee 1981). Since, several authors have contributed to barriers to entry theory. Among the latest studies are McAfee et al. (2004), whom conceived the division between economic and antitrust barriers. Recently Pehrsson (2009), building on insights of Hambrick (1983) and Peteraf & Reed (2007) presented a model combining the barriers to entry and new entrants' market entry strategies. According to his study (Pehrsson 2009), a new entrant faces extensive exogenous and endogenous barriers and therefore chooses a broader market scope than an earlier entrant. Exogenous barriers are entrenched in the underlying market conditions. Therefore, companies cannot control barriers at issue. These include incumbents' product differentiation, need for capital, customers' switching costs, number of competitors and government policy, to name few. On the contrary, endogenous barriers are generated by the companies through the market strategies and the competitive behavior. These barriers are based on incumbents' reactions towards new entrants' establishment plans, for example incumbents' price competition. (Pehrsson 2009) Nonetheless, Gable et al. (1995) state the entry barrier types are often reinforcing, which might complicate the interpretation. Pehrsson (2009) also notes incumbent strategy affects on market entry barriers, and therefore impedes the market entry of potential newcomers.

According to earlier studies (Brewer 1996; Ludvigsen & Osland 2009; Mäkitalo 2007; Steer Davies Gleave 2003) the main barriers to entry in railway freight market are exogenous: acquiring the rolling stock and bureaucracy. However, there are differences between countries. Brewer (1996) noted perceived level of access charges was a barrier in UK; in

Finland (Mäkitalo 2007) and Sweden (Steer Davies Gleave 2003) researches estimated the difficulty of accessing the services creates a great market entry barrier. Minor barriers to entry concluded long market entry phase, recruiting staff and inadequate railway capacity. Mäkitalo (2007) noticed also endogenous barriers are present in Finland: the actions of the market dominating company might complicate the entry process.

Market entry process consists of several steps. Before actually entering the market, Koch (2001) suggested newcomers should become acquainted with internal and external factors affecting on the entry mode's selection, subjects such as environment's characteristics, competencies, capabilities and skills required / available and own experiences, to name few. According to several studies (Robertson et al. 2003; Sørheim 2005), the main problems start-ups face when entering the markets are financial by nature. In addition to financing by banks, start-ups can pursue help from venture capitals or business angels (Deakins 1996; Wiltbank 2005). In the case of mature firms, vertical integration, strategic alliances and subsidiaries are the mostly used forms (Blomstermo et al. 2006; Kotler 1988; Kotler 2000; Lee et al. 2000).

3. Methodology

Hirsjärvi et al. (2004) state qualitative research's main intention is to understand the research subject. The main difference between qualitative and quantitative research method is their nature: qualitative concentrates on words whereas quantitative research main focus is on numerical data (Eisenhardt, 1989). Yin (1981) theorized although case study is often integrated with qualitative research, as well it can involve only quantitative data, or both. Although interviews can disclose both qualitative and quantitative data (Eisenhardt, 1989), this research is qualitative by nature. Häkkinen & Hilmola (2005) stated case study research has become a widely used research strategy in logistics. They concluded logistics case studies mainly concentrate on descriptive research objectives (Häkkinen & Hilmola, 2005). Because this study is logistical by nature and it attempts to give proposals for improvement as well as to describe the current situation, research is mainly descriptive analytical but it embodies also normative methods (Routio, 2007).

Kathleen M. Eisenhardt (1989), building on insights of Van den Ven and Poole, argues case study method is especially feasible when studying new topic areas. In addition, because case study approach does not rely only on previous literature or prior empirical evidence, theory building from case study research is especially appropriate (Eisenhardt, 1989). This

explains why case study method was chosen as a research method in this particular research. Due to lack of earlier first-hand empirical data, by interviewing the experts from several companies author was able to gather genuine information at actor level. In compliance with Eisenhardt (1989), close interaction with the topic produces theory which closely reflects reality.

4. Research approach and data collection

Today there are 17 railway undertakings in Sweden who have a licence to practice railway freight traffic. Polish market has more licenses: altogether over 90 operators have the license; 49 are counted as active operators. Because the research's objective was to gather genuine information from the experts, a half-structured theme interview was chosen as a data collection method. Theme interview was introduced first time in 1956 by Merton, Fiske and Kendall in their book "The Focused Interview". Starting from 1980's theme interview has been the mostly used interview method in business economics; often it is seen as a synonym for qualitative research (Koskinen et al. 2005). Theme interview focuses on certain themes; it is a semi-structured interview method, which is placed between a form interview and an open interview. The interview proceeds in compliance with themes without setting significance on single questions. There is no correct order to proceed: the subject discussed transfers to next theme. In a good theme interview researcher can deepen the conversation by concentrating on subjects related to the interviewee. Additional questions can be added. Although the exact form and order of the questions is not important, theme interview is not as free as in depth-interview (Hirsjärvi & Hurme 2001).

According to Hirsjärvi et al. (2004), by a test-interview themes' adequacy can be confirmed and interview's duration can be checked. Questionnaire's validity was checked by organizing a test-interview with a company that intends to enter the Finnish rail freight market in 2010. According to interviewee's comments, few questions were added to the questionnaire. Hirsjärvi et al. (2004) state reliability means the repeatability of the results. Research reliability was confirmed by recording all interviews, assuring the possibility to recheck the data if needed.

All interviewees were managers or experts with a long history in railway market or logistics. Altogether seven companies (nine persons) were interviewed from Sweden and nine companies (ten persons) from Poland.

5. Swedish market

According to interviewed operators, the main barriers to entry are exogenous by nature: rolling stock / locomotives and bureaucracy (see figure 1). Due to high fixed costs the investments in railway industry are mainly locomotives / rolling stock. Five from six interviewees stated bureaucracy is a great market barrier; locomotives / rolling stock were stated four times and investments three times. In compliance with two respondents, also network capacity is a problem. Difficulty to find a customer and loading areas were mentioned once. Worth mentioning is a fact endogenous barriers were not mentioned.

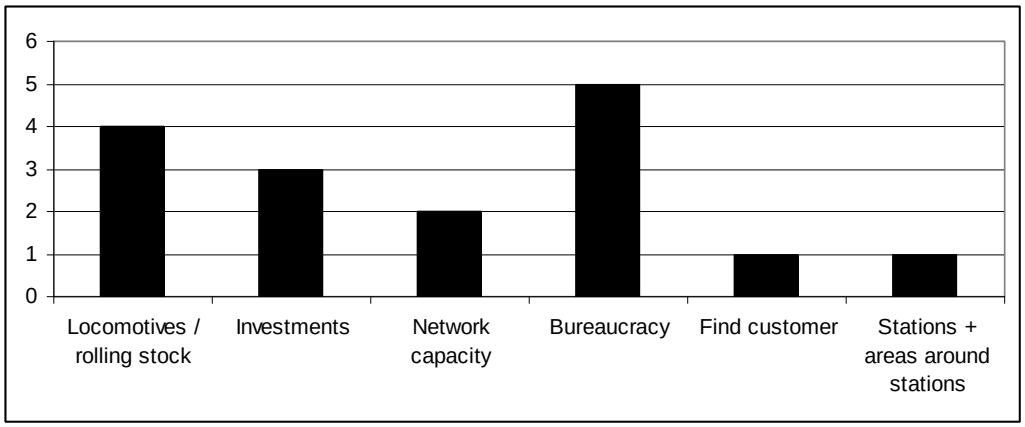

Figure1. Market entry barriers (Sweden).

When comparing the results with earlier studies, both similarities as well as differences are noted. Investments, acquiring the rolling stock and bureaucracy are stated as the main barriers also in previous studies. Especially bureaucracy unfolded several times in the interviews. The main discrepancy is in accessing the services, which is stated as a barrier to entry in previous studies (Mäkitalo 2007; Steer Davies Gleave 2003). Additionally, Mäkitalo (2007) described recruiting personnel is a market barrier. According to this research, engaging employees is easy.

Swedish operators' market entry has national peculiarities, due to the Swedish State Railways (Statens Järnvägar, SJ) strong background. In 1994 SJ decided to cancel unprofitable short-lines. However, personnel noted business could be profitable by making minor changes. After SJ discontinued the operation, three new operators were established to sustain the work. Therefore four companies have straight connection to SJ: one was the old SJ Freight, while three companies were start-ups operating in old SJ regional lines. In addition, one start-up entered the market as a late entrant and one company via vertical integration.

Because 66.7 per cent of interviewed companies had roots in railway market, they were well aware of external and internal factors affecting on entry mode's selection. The personnel had strong market experience, which Koch (2001) noted as especially important factor.

All companies had excellent knowledge of railway freight industry before entering the market. The reason is the personnel: every company was able to attract old SJ employees. However, according to interviews, there are some differences between the companies. Few interviewees stated governmentally owned SJ has lower retirement age than private operators (60 vs. 65) and therefore locomotive drivers prefer working for governmentally owned operator. One interviewee said their strength is a versatile loco fleet: drivers are interested in joining the company because the fleet enables drivers to use their all skills. According to one respondent, drivers are looking for open vacancies in small companies, because they prefer working in a smaller work community. All interviewees' emphasized employees are their key asset; without employees there are no transport and therefore no business. Many operators described there has happened a huge change in work culture; *"nowadays it is important that people have many skills, that they have multi-functional knowledge. This way same person can do many tasks… This increases the cost-efficiency."* In addition to cost-efficiency, interviewees noted various tasks increase the work-satisfaction.

According to Robertson et al. (2003), the main obstacle for new entrants is finance. Macht & Robinson (2009) & Sørheim (2005) supported the study and concluded the start-ups face considerable challenges in achieving long-term finance. Without doubt, the biggest financing object in railway is rolling stock. However, because four companies started to operate in old SJ regional lines, they we able to acquire the rolling stock from SJ. One company acquired old railway undertaking, including the rolling stock; therefore, only one company had to acquire locomotives and wagons.

Kotler (2000) notes companies can be classified into two types: competitor-oriented and customer-centered. By overseeing customer needs, operator can decide which customers' needs are the most important to serve with the possible resources and objectives. (Kotler 2000, 247 – 249) Five of the interviewed companies informed the reason to enter the market was customers' request; this presents 83.3 per cent of all interviewed companies. Although one company did not state directly the reason was the customer, interviewee noted: *"customer is always behind the market entry."*

6. Polish market

Polish market faces several barriers to entry. The main barriers are rolling stock acquisition, investments and bureaucracy, all exogenous by nature. Three companies thought investments / rolling stock is the only barrier, four companies specified also other factors. According to three companies, bureaucracy is an entry barrier. Network capacity and market knowledge were mentioned once. Additionally, endogenous barriers are noticed in Polish market: according to one respondent, competition with the market leader is a barrier to entry.

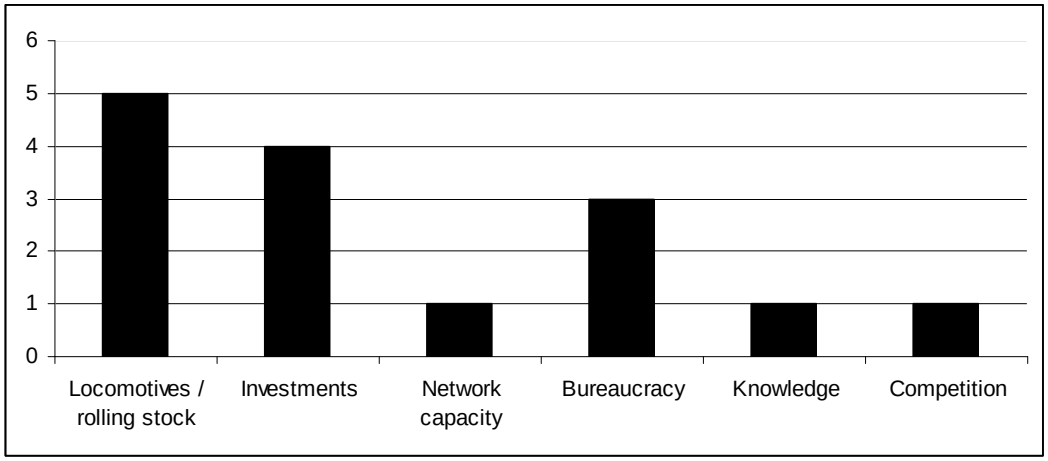

Figure 1. Market entry barriers (Poland)

Generally all operators entered the market within four years, 2001 – 2004. However, when examining only the private operators who entered the market after the liberalization, the year distribution narrows down to two years, 2003 and 2004. Although one company, earlier monopoly holder, had the first mover advantage, other interviewed operators entered the market within the same timeframe. Vertical integration was used by five companies, having background from heavy industry and construction. Although one company was a new entrant on Polish market, operator belongs to a bigger corporation and is therefore a subsidiary. The seventh operator is the old governmentally owned company.

The reason to enter the Polish railway market differed dramatically. Three companies were customer-oriented which states 42.9 per cent of interviewed operators. Two companies saw a market opportunity due to market's size; one needed financial backup. Naturally, one company was the old national operator. Although only one company had background in railway transport, other counterparts had gained market knowledge via various ways. Therefore all newcomers were aware of railway market's internal and external factors. For

example, by acquiring personnel during the vertical integration process operators assembled knowledgeable employees.

According to Robertson et al. (2003), the main obstacle for new entrants is finance. Without doubt, the biggest financing object in railway is rolling stock. In Poland operators gathered rolling stock by various means: vertically integrated companies acquired the rolling stock from parent company. However, Polish railway market faced a critical situation due to national operator's unwillingness to acquire locomotives, although there was untapped fleet available. Due to this national peculiarity, operators had to buy rolling stock from abroad, countries like Czech Republic, Romania and Germany. In order to fulfill the requisite standards, all units acquired had to pass remarkable maintenance work, which naturally paid up exceedingly. As one interviewee stated: *"We had to invest eight to ten million dollars only for repair work!"*

7. Discussion

Although Polish and Swedish markets confront discrepancies, several similarities are known. The main barriers to entry are exogenous; acquiring rolling stock, needed investments and bureaucracy. However, countries involved have some special characteristics. The Swedish operators stated respectively bureaucracy, rolling stock and investments. In Poland same factors in different order were stated: rolling stock acquisition was seen as a major entry barrier, following with investments and bureaucracy. In both countries bureaucracy associates with needed paper work: great number of needed documents and certificates surprises. Title "bureaucracy" includes also the entry process, which was seen long and exhausting. Although persons had decades experience on the market, process was seen impossible without help from consultants and experts. The fact Swedish operators saw bureaucracy as a bigger problem than Polish counterparts might be courtesy of the western business style: in western countries people are used to few papers; in eastern countries countless needed documents, stamps and signatures are ordinary. This might conclude the fact Polish operators saw bureaucracy only as third biggest barrier, after rolling stock and investments.

Because the main investments in railway market are locomotives and wagons, investments and rolling stock can be seen partly united entry barrier. Few operators stated terminals and loading areas as investments; however, the majority of the interviewees saw rolling stock as the main investment. The main reason why rolling stock was seen an entry barrier lies in

availability of rolling stock and the price of locomotives and wagons. Although wagons are not expensive when bought individually, generally operators need to buy bigger fleets at once which increase the needed capital. Locomotives are extremely expensive; the price of a new locomotive is around three to five million Euros, depending on the locomotive's characteristics. Generally new entrants do not have capital to buy new units, therefore companies prefer second hand locos. Although the governmentally owned operator in Sweden has sold old locomotives to private undertakings, in order to satisfy the demand operators have bought second hand locomotives from countries like Germany, Austria and Denmark. Polish railway undertakings have acquired engines from Romania, Czech Republic and even from Morocco. The need for foreign locomotives is greater in Poland, arising from the fact the governmentally owned company do not acquire any of its old locomotives to private operators, although there are hundreds of locos unused. This might explain why rolling stock and especially locomotives was seen as major entry barrier in Poland.

Other entry barriers represent a minor role in studied countries. Network capacity and need for sidings / terminals is noted in this and Mäkitalo's research (2007). However, some discrepancies are visible. In this study railway undertakings did not mention long market entry phase as a barrier, although it came up in few conversations. Competition with the market dominating company was stated only once, therefore it can not be seen as a serious barrier. The main discrepancy lies in staff recruitment: this research's outcome states there are no difficulties to recruit staff. In actuality, several interviewees noted there is well educated and experienced staff available. It seems some employees prefer working in smaller companies, where people know colleagues and work is more relationship-based. Many interviewees stated an adequate mixture of old and new staff is an ideal situation: this ensures the know-how is transferred to new generation, together with the latest knowledge.

Due to the fact countries concerned, Sweden and Poland, liberalized the railway freight market in different time, the markets have differences. Sweden started the liberalization process in 1988 and Poland in 2000; first private operators entered the markets in Sweden 1990, although the access to whole network was granted only in 1996. (Alexandersson & Hulten, 2005) Polish railway freight market faced the first private entrant in 2003 (PKP PLK, 2009). However, due to national peculiarities like the type of main industries, we can assume the situation would have been the same although countries' would have done the process concurrently. The interviewees have entered the markets in the early stage; vertical integration

and start-ups are the main market entry strategies used. Strong interest towards liberalized market can be seen in both countries.

The difference between Sweden and Poland is clearly visible. In Sweden the mostly used market entry strategy was start-up, whereas Polish operators employed vertical integration. Other entry strategies presented a minor role. This states the great difference between these two countries: in Poland the governmentally owned enterprise did not privatize and enable market possibilities for new operators. In Sweden SJ decided to open business opportunities for new start-ups in unprofitable areas. At the same time, situation describes the countries' industrialization: in Sweden –likewise in Finland– the main industries include pulp, timber, paper and steel, which transport is outsourced to railway operators.

In Poland the main industry sectors are mining, including iron and coal, and steel products. Due to market's size volumes are really high, which enabled companies to start their own transport companies. This reinforces the relationship between the operator and customer. Therefore we can state the customer-driven model is starting to increase its market share in Eastern Europe. However, the difference between western and eastern country is still visible: when entering the markets, customer-centered strategy was used by 42.8 per cent Polish operators, compared to Swedish 83.3 per cent. Although customer service and customer-orientation is starting to grow in Eastern Europe, it still has a long way to the Western European level.

8. Conclusions

Although the markets are developing, both in Sweden and Poland the old monopolistic company has the main market share. In Sweden Green Cargo leads the way with 75 per cent, PKP Cargo has 78 per cent. However, due to market situation and the hard competition, both markets are changing. Especially in Poland the competition is hard, and governmentally owned operator loses market share to smaller operators. In Sweden the same situation is visible in smaller scale. The sampling presents a good cross-section of the railway freight market: from both countries the leader, challengers and nichers were interviewed. Therefore this research's sampling is congruent and extensive in both countries.

This article presented the main barriers to entry confronted by the private operators when entering the markets, as well the main market entry strategies. Research supports earlier studies and concludes the main barriers are acquiring of rolling stock, bureaucracy and needed investments. However, some national peculiarities were unfolded: in Poland competition with the market leader was stated as a barrier. The discrepancies are more visible when researching the utilized market entry strategies: in Poland companies used vertical integration, whereas in Sweden new companies were established on the basis of old Swedish Railway. However, both markets are growing, which enables opportunities for new railway operators.

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Evaluating regional transportation systems under emergency situations

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Abstract
Around 85 percent of Finnish trade is transported using sea. Furthermore, Finnish and Estonian ports handle a major share Russian trade flows. Although the functionality sea transport is vital for the region, there are no studies on how the system behaves and should be operated when facing different changes in operational environment.

In the Stoca project the future cargo flows in the Gulf of Finland will be examined under scenarios presenting alternative local development of the regions as well as emergency situations. In the scenarios constructed we analyze the capacity and potential for alternative routing in Finland and Estonia.

The evaluation is based on simulation models. The results of the project enable business actors and authorities both in Finland and Estonia to increase their readiness to act and react in extreme as well as in stable operative situations by reviewing their strategies and operations based on equipment utilization and throughput of the transportation system.

Keywords: Simulation, transportation systems, sea ports

1. Introduction

The role of transport in the economy is twofold. As a sector of economic activity it contributes to a share of national income and transportation provides means to realizing that output (Quinet and Vickermann, 2004). From logistical point of view Finland is like an island; around 85 percent of trade is transported using sea. Furthermore, Finnish ports handle a large part of the container transit to Russia, while Estonian ports handle a major share of the oil export from Russia. The functionality of the transport system using sea road is vital for the region, as 74 % of the trade of the Baltic Sea Region States is transported by sea.

Because of its complexity, simulation is sometimes referred to as the last resort when selecting problem solving tools (Law 2006; Stevenson 2007). Therefore, one needs to justify the use of the method. According to Banks et al. (2005) the applications of simulation in transportation systems are vast (recent examples can be found e.g. in: Tervonen et al., 2008; Rijsenbrij & Ottjes, 2007; Coleno, 2008; de Jong & Ben-Akiva, 2007; Godwin et al. 2008; Kidokoro, 2006). Transportation systems are a typical example of complex real-world systems, which cannot accurately be described by analytic methods. Ujvari and Hilmola (2006) show in Automated Guided Vehicle context explicitly that minor system details, which can be incorporated in to a simulation model but typically cannot be dealt with using other

tools, can have major impact on system performance. According to Ujvari and Hilmola (2006) such features include e.g. the control and loading logic applied as well as physical properties of the transportation system.

This research is structured as follows: In Section 2 we shortly review the role of transportation in economic activity. Following Section 3 introduces simulation as problem solving tool and compares its characteristics with other techniques. Thereafter, in Section 4 we present the STOCA (Study of cargo flows in the Gulf of Finland in emergency situations) project, in which the objective is to analyse the functionality of the sea transportation system in the Gulf of Finland under different conditions.

2. The role of transportation in economic activity

The role of transport in the economy is twofold. As a sector of economic activity it contributes to a share of national income. Furthermore, it provides means to realising that output. As derived demand, the growth of transport follows the trend of general economic activity. On the other hand, improvements in transport infrastructure create room for accelerated economic growth (Quinet and Vickermann, 2004).

According to Rodrigue (2006) improvements in transport and distribution have contributed to significant changes in the geographies of production. Furthermore, Gulyani (2001) argues that a poor transportation system might lead to geographical clustering of manufacturing industries. The state of the transport system has also affected population growth of different geographical areas; highways have typically been advantageous for population growth. Railroad has even been identified as the most significant contributor to the settlement of the western parts of the United States (White, 2008).

Within EU transport accounts for 6.9 percent of national output (Eurostat, 2008). Earlier the share was diminishing, but recently the growth in transport has exceeded the growth of national output (Quinet and Vickermann, 2004). Sea transport is the dominant transportation mode in the region as about 76% of trade in BSR states is transported using sea transportation. In addition to serving national import and export, Finnish ports and Estonian ports are also used for Russian trade flows.

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3. Simulation as a problem solving tool

According to Law (2006) the ways to study a system can be classified as in Figure 1.

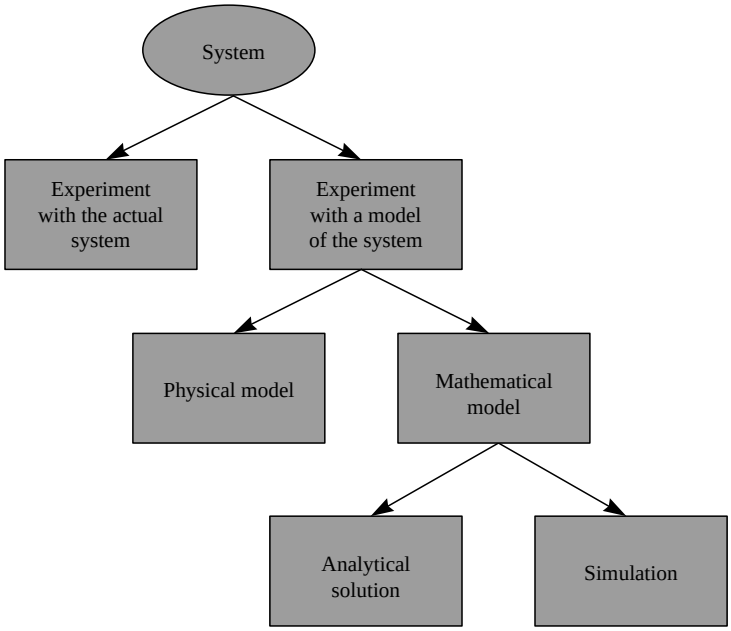

Figure 1 Ways to study a system (Law, 2006)

If it is feasible and cost effective to experiment using the actual system, this is the desirable way to go. This is recommended, because the study should be relevant. Sometimes the system under study cannot be disturbed or does not even exist. An example of physical (also iconic) models are the clay cars used in wind tunnels. Mathematical models represent the system in logical or quantitative relationships, which can be altered to see how the system reacts under different conditions. Guedes (1995) mentions also analog models that use other physical properties to model a system.

If the mathematical model is simple enough to be solved exactly, this solution is called an analytic solution. If an analytical solution to the mathematical model is available and it is computationally efficient, it is usually preferred over simulation because it is optimal. Law (2006) refers to simulation as the last resort. The same idea can be found behind the problem solving tool selection process presented by Stevenson (2007), which is presented in Figure 2.

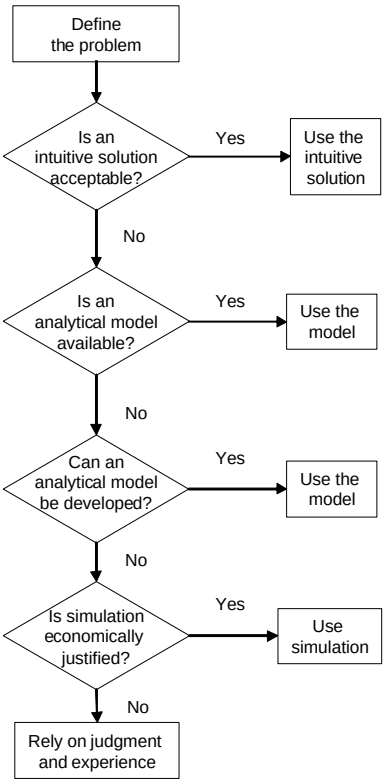

Figure 2. Problem solving tool selection process (Stevenson, 2007)

According to Stevenson (2007) simulation should be applied only if analytical solutions are not available.

Mathematical techniques

The main Operations Research techniques are optimization, heuristics, and simulation. There are also simple symbolic replications (Bowersox et al., 1986), which can be presented on spreadsheets in computerized form. Guedes (1995) defines hybrid models, which combine simulation and optimizing algorithms in one model.

Optimization techniques are mathematical techniques that arrive at an analytical solution (Law, 2006). A heuristic comprises a rule, which restricts the number of alternative solutions to a problem. The heuristic approach to problem solving attempts to maintain the level of detail of simulations, while offering the best solution search capability of optimization approaches (Ballou, 1989). Heuristic models can be used to solve more complex and less well-structured problems than optimization (Guedes, 1995). The heuristic approach is to be used when the problem solving method has to provide search capability, ruling out simulation

and no optimization method exists or it cannot be solved within given time limits. According to Bowersox et al. (2007) routing problems have historically been computationally too complex to be solved analytically. Spreadsheet models refers to the way the techniques are presented in computerized form. According to Bowersox et al. (1986) these techniques include comparative analysis, break-even analysis and flow charting.

Guedes (1995) compares the use of optimization, heuristics and simulation in problem solving. The summary is given in Table 1. The evaluation of spreadsheet models presented in the table is originally given by Seppälä (1995).

Table 1 Comparison of different techniques (Guedes, 1995; Seppälä, 1995)

	Spreadsheet Models	*Optimization*	*Simulation*	*Heuristics*
Easy to use	Yes	No	Yes	No
Flexible modelling	Yes	No	Yes	No
Computer time needed	Low	High	Low	Low
Realistic modelling	Yes	No	Yes	Yes
Guaranteed improvement	No	Yes	No	Yes

As optimization and heuristics offer a solution search algorithm an improvement in the solution is guaranteed. Although the computer time needed for a simulation study might be high, in very complex problems it is lower than finding an optimal solution. As the computer time needed for optimization increases with model detail, realistic modelling is not supported by using the technique. On the other hand, the computer time needed in heuristics is not so sensitive to model detail, so more realistic models can be built.

Furthermore, the suggested relative ease of use of simulation in comparison to heuristics and optimization, provided by commercial simulation software packages, is partly dependent on application area. Currently, for routing and supply chain planning problems, there are software packages available, with graphical use-interface and built in optimization and heuristic algorithms. Although simulation software might be easy to use, the technique itself requires special training. (Banks et al., 2005; Chung, 2004; Ljung & Glad, 1994)

Simulation

Naylor et al. (1966) define simulation as the process of designing a mathematical or logical model of a real system and then conducting computer-based experiments with the model to describe, explain, and predict the behavior of the real system.

Simulation analysis is a descriptive modeling technique. It does not provide explicit problem formulation and solution steps like linear programming. Descriptions of the structure of simulation analysis can be found for example in Banks et al. (2005) and Law (2006). Persson (2003) provides a comparison of different simulation project methodologies found in the literature concluding that they are all similar in structure. The particular procedure described here can be found in Hoover & Perry (1989). The procedure is illustrated in Fig. 3.

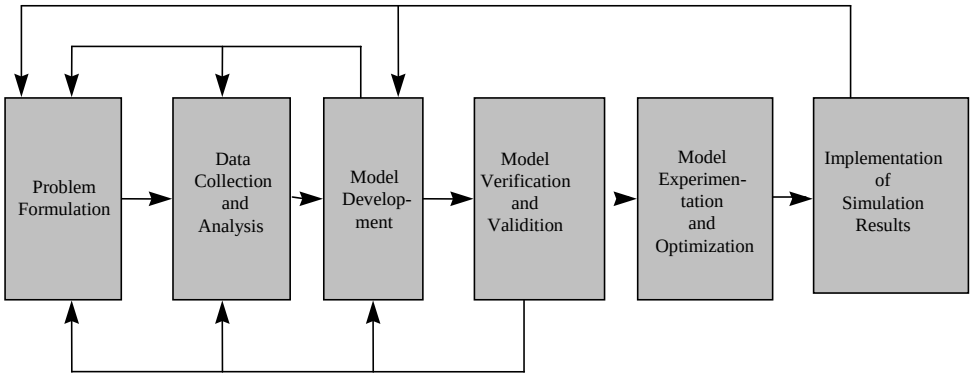

Figure 3 Elements of a simulation analysis (Hoover & Perry, 1989)

As the pointed arrays show, the analysis is an iterative process. The results and knowledge gained during the latter phases can, for example, influence the problem formulation. Problem formulation can be seen as the most important step in simulation analysis. Before a problem can be formulated, it must be identified. This requires some prior knowledge of the system in question. Because simulation as a method does not include any solution searching algorithm the configurations to be studied should be limited. (Law, 1998) According to Chung (2004) the need for a formal problem statement and project objectives cannot be overemphasized. As model validity is defined only within the context of the problem formulation (Law, 1998), i.e. model is built to finding answers to specific questions, redefinition of objectives during a project might require building a new simulation model or even call for re-evaluation of alternative problem solving as suggested by Stevenson (2007). According to Law (1998) data is collected to serve two purposes: to specify model parameters and input probability distributions and to later be able to validate the model built by comparing its performance to the existing real system. The information collection on system layout and operating

procedures should not be based solely on one source. As data sources may be inaccurate and operating procedures may differ. (Law, 1998)

In order to be able to build an appropriate model one has to understand the system. A logic flow chart of the system can be constructed and then coded on the simulation software. Furthermore, the choice of modeling approach may be dictated by the simulation software selected. (Chung, 2004; Hoover & Perry, 1989) According to Law (1998) conceptually, a valid model can be used to forecast the real system performance. The ease of validation depends on the existence of the real system. There is no absolute model validity, i.e. model validity can only be defined within the context of the problem formulation

Because a stochastic model produces estimates of the true characteristics of the system, several observations for each set of input parameter values is needed. In order to be able to construct confidence intervals based on these observations, the observations have to be obtained from different runs. Simulation is therefore better suited to comparing a limited number of alternatives than optimizing a system. (Law, 2006) Simulation models are often expensive and time-consuming to develop. Model building requires special training, and even when constructed by competent individuals, models will hardly be the same. (Banks et al., 2005)

In discrete-event simulation the state variables can change only at countable number of points in time. Continuous simulation concerns the modeling of a system by a presentation in which the state variables change continuously over time (Law, 2006). If a high degree of precision is not required, continuous flows can be converted into discrete units of measure. Vice versa discrete state changes that occur at small intervals can be modeled using continuous change logic. (Harrel & Tumay, 1997) Some systems include both discretely and continuously changing variables, resulting in combined, discrete-continuous simulation. For example, a continuous state variable may achieve a threshold value and cause a discrete event to occur. (Law , 2006)

Borschev and Filippov (2004) distinguish between discrete-event system simulation, agent based simulation and system dynamics modeling. In agent-based modeling individual actors behavior is modeled; the dynamics of the system is derived from the interaction between the actors. Furthermore, in discrete-event simulation discrete units flow inside a system, while resources offer services to the units.

The history of system dynamics states back to the article ‘Industrial Dynamics--A Major Breakthrough for Decision Makers’ by Jay W. Forrester, which was published in Harvard

Business Review year 1958. The book titled Industrial Dynamics, also by Forrester, was published in 1961. According to Borshev and Filippov (2004) system dynamics modelling differs from agent-based and discrete-event simulations in the high level of abstraction. According to them agent-based modeling can be used on any level of abstraction while discrete-event modeling cannot be done in a high level of abstraction. Also, agent-based modeling is a bottom up modeling method, while system dynamics is a top-down method. System dynamics also uses differential equations, while agent-based modeling and discrete-event simulations do not. (Borshchev & Filippov, 2004)

Recent applications of simulation in transport system analysis

Simulation has been widely used in transport system analysis. Applications range from elevator planning and airport baggage handling system design (Tervonen et al., 2008; Rijsenbrij & Ottjes, 2007) to evaluating segregation strategies of genetic manipulated grain (Coleno, 2008) and modeling of national freight systems (de Jong & Ben-Akiva, 2007). Godwin et al. (2008) use simulation for tactical locomotive fleet sizing for freight trains. Simulation has also been used for assessing different regulatory methods in congested transport systems (Kidokoro, 2006). Although simulation is often seen as an alternative to other analysis tools, it can also be used in combination with them. The Canadian Pacific Railway has used an optimal block-sequencing algorithm, a heuristic algorithm for block design, simulation, and time-space network algorithms for planning locomotive use and distributing empty cars when changing their service concept (Ireland et al., 2004). Cheng and Duran (2004) report a decision support system for managing transportation and inventory in a world-wide crude oil supply chain. The tool is based on a discrete-event simulation model and dynamic programming. Recently simulation has been used also in analyzing sea transportation. For example Engelen et al. (2006) have used system dynamics for a strategic and tactical decision making model for ship owners in the dry bulk sector. Ottjes et al. (2006) have investigated the future capacity needs of the Rotterdam port area. Their results include the requirements for deep-sea quay lengths, storage capacities, and equipment for interterminal transport. Further traffic flows on the terminal infrastructure are determined, and the consequences of applying security scanning of containers are evaluated. Douma et al. (2009) have evaluated effect of information exchange in the Rotterdam port area on the waiting profiles. Tu and Chang (2006) have analyzes operations of ditch wharfs and container yards in future mega-container terminals by using simulation. Grunow et al. (2006) have

analysed strategies for dispatching AGVs at automated seaport container terminals in single and dual-carrier mode

4. STOCA-study of cargo flows in the Gulf of Finland in emergency situations

The Baltic Sea Region including Estonia, Latvia, Lithuania, Poland, Denmark, Sweden, Finland, Norway, north-western Russia and northern Germany is an area of high economic growth. Sea transport is the dominant transportation mode in the region as about 76% of trade in BSR states is transported using sea transportation.

In addition to serving national import and export, Finnish ports and Estonian ports are also used for Russian trade flows. Although the functionality of the sea transportation system is vital for the economies in the region, there are no studies on the operability and throughput capacity of the transportation environment under unexpected disturbances or more stable long term changes. Sudden changes would include for example closure of ports caused by economic or environmental crisis.

In the STOCA project the cargo flows in the Gulf of Finland will be examined from continuous growth perspective. This analysis reveals possible bottlenecks of the system. Also alternative future development paths of the regional industry and transportation will be used as scenarios.

The analyses will be used to evaluate strategic and operational actions of business actors and the authorities. As an example, we analyze the capacity and potential for alternative routes in Finland and Estonia and estimate changes in traffic patterns, vessel sizes, railway tunnel between Helsinki and Tallinn.

In addition to the coordination work package, for which Merikotka is responsible, the project consists of four work packages, WP’s. Centre for Maritime Studies, University of Turku is responsible for producing basic data of current cargo flows, infrastructure and actors in the Gulf of Finland. In addition, future changes and cargo flow development are estimated. Based on these analyses, alternative routes for traffic flows in case of an emergency are studied.

The Northern Dimension Research Centre (NORDI), Lappeenranta University of Technology is responsible for alternative scenarios of operational environment in the extreme situations. Possible emergency situations and the consequences for the actors in business and public sector are identified.

Estonian Maritime Academy determines threats posed by crises for energy traffic flows in the Baltic Sea region and especially in the Gulf of Finland. The analysis will discuss oil and chemical flows and alternative routes, environmental, social, economical and political risks associated with oil transportation in emergency situations.

Kouvola Research Unit, Lappeenranta University of Technology will analyze the different types of emergency situations, identified in the other WPs through computer based simulation models. System dynamics simulation is used for this purpose to the extent that is possible. Also more advanced simulation models are used. The models to be built are not fully specified as the level of detail of data available has not yet been confirmed and the disturbance scenarios have not yet been specified. Figure 4 presents the Sea Transportation System Model Framework of the project.

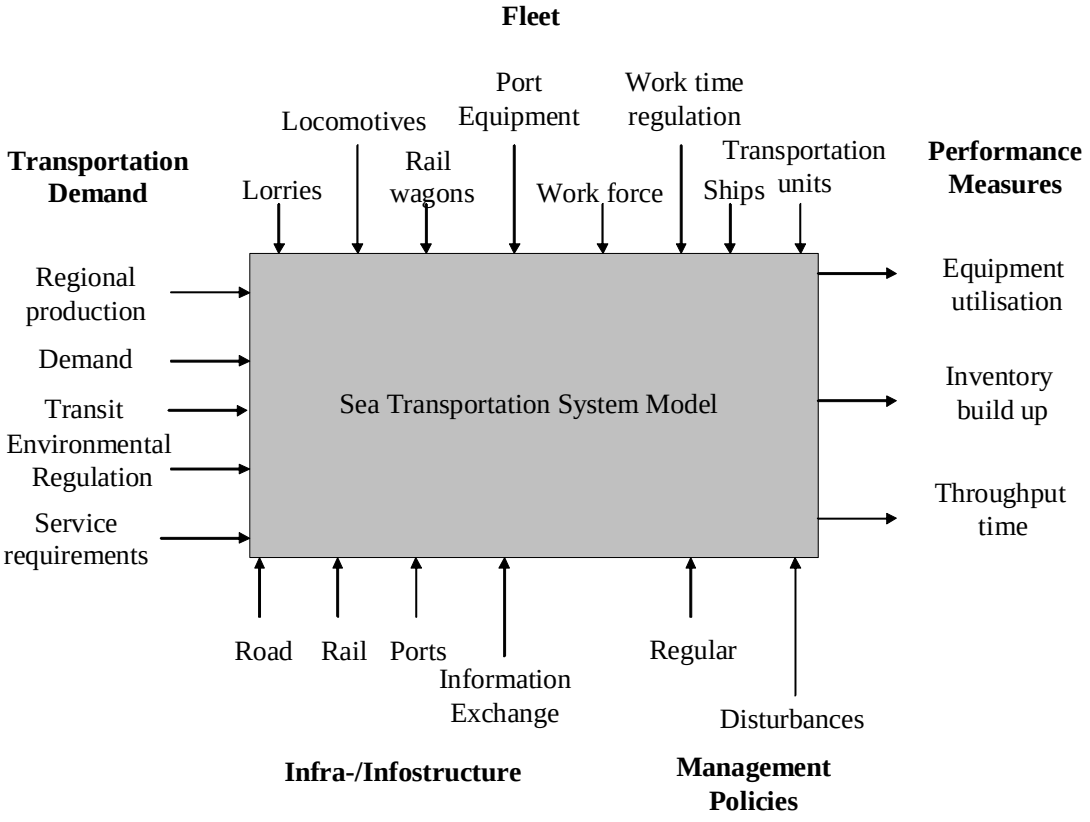

Figure 4 Sea Transportation System Model Framework

In the framework transportation demand is partly caused by exports of regional production and import demand. Transit traffic is caused by economic activity and lack of infrastructure outside the region. Environmental regulation might limit the use of the infrastructure and service requirements could for example have an effect on the frequency of the operations.

The demand for transport is fulfilled using the infrastructure and fleet available. Work

time regulations include the availability and duration of extra capacity when the system faces unexpected disturbances in demand, infrastructure or fleet. The performance of the system is evaluated based on equipment utilization, inventory built up and through put time. Using the model the functionality of different system configurations and effectiveness of management policies can be evaluated under different demand scenarios.

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Modeling seaports with agent-based modeling and system dynamics

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Abstract
Seaports are an important part of logistical systems and the amount trade through sea has increased enormously since the Second World War. In order to properly manage a seaport the capacity of the whole system needs to be high enough compared to the demand imposed by customers. As the amount of investments required in a seaport are large and require a long time, it is important to estimate the future demand as accurately as possible. Simulations are one possible way to study how a system develops through time. In this paper two simulation models are built with different simulation approaches, one with system dynamics and one with agent-based modeling. Both of the simulation models study how well a seaport is able to cope with its demand. The capability is studied by calculating the average queue in the seaport and by calculating the average utilization of the seaport. This paper shows what are the advantages and disadvantages with both of the methodologies in analyzing the development of seaports. The building processes for both of the simulation models are also presented so it is possible to use the frameworks to study other seaports as well. This study indicates that it is possible to study the Finnish and Estonian seaports using either system dynamics or agent-based modeling and both of the models can easily be expanded to study emergency situations in the Gulf of Finland. Agent-based modeling was found to be a more suitable approach for studying seaports.

Keywords: System dynamics, Agent-based modeling and simulations, Seaports

1. Introduction

Seaports play an important part in the Finnish foreign trade flows as over 75 percent of trade (in tons) happens through seaports (National Board of Customs, Statistics Unit 2007). On a global scale the amount of trade through sea is enormous and trade using containers has increased to 142.9 million TEU a year (Drewry Shipping Consultants 2007). As the world becomes even more connected through globalization, this trend will most likely continue to grow (IMF 2007).

As seaports usually require significant investment from companies or governments (in Finland most ports are owned by municipalities), estimating their development plays an important part. They also play an important part in the competitiveness of the national infrastructure and thus have an indirect impact on the competitiveness of companies. Seaports should be able to offer quick service for the ships in order to remain competitive. In addition to competitiveness of a nation, seaports play an important part in the overall wellbeing of a nation as most countries are heavily dependent on trade (for instance, in Finland the amount of exports and imports are 44.5 percent and 39.3 percent, respectively, from the Finnish GDP) (SF, Economic Statistics: National Accounts 2007).

The objective of this study is to understand how individual seaports can be simulated. The research question can be presented as:

How can a seaport be simulated with reasonable accuracy using System Dynamics or agent-based modeling?

This can further be expanded to include two sub-questions:

What are the advantages and disadvantages of system dynamics and agent-based modeling in simulating seaports?

Is it possible to create a simulation model which will calculate the average queues and waiting times at the individual seaports?

System dynamics (SD) and agent-based modeling and simulations (ABMS) were selected as possible methods as they have different kind of approaches to studying complex systems (Phelan 1999). As seaports handle different kinds of cargo (dry bulk, liquid bulk, and general goods cargo), this paper will only concentrate on one of the cargo types. Different cargos require different kind of equipment at the seaport so it is not reasonable to simulate all of the different kinds of cargos in the same way. Also, demand is imposed on the seaport from an external source and it is not simulated in this paper.

This paper is structured as follows: In section 2 some general information about seaports are presented. Section 3 presents SD while section 4 is about ABMS. These sections show some general information about the simulation approaches, but they no dot include any information about the actual simulation work. The 5 section explains the chosen methodology in this paper while section 6 contains the actual simulation models. In this section the basic assumption behind both simulation models are presented. Section 7 shows the results obtained from both of the simulation models and discusses the differences between the approaches. The final section 8 concludes this paper and offers avenues for further studies.

2. Seaports

Winkelmans (2002) has summarized some definitions for ports from numerous sources. One definition for a seaport is: an area of land and water, where reception, loading, and unloading of ships is possible in conjunction with storage of goods, and there is a connection to inland transportation. Other definitions see seaport as a logistical and industrial center which plays an active role in global transport system. Winkelmans (Winkelmans, 2002) continues by stating that it is difficult to give a definition to seaports as these include different transport chains, equipment required to conduct these logistical operations, and there is a large diversity of different terminals.

As logistics plays an important part in these definitions, it also needs to be defined. According to the Council of Logistics Management, logistics management is *"part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements"* (Council of Logistics Management 2008). According to this definition, logistics also include the flow of information and services, not merely goods. Also, logistics is part of supply chain management. Vafidis (2007) has summarized definitions for supply chain management. According to Vafidis (2007) the definitions for supply chain management differ greatly between different researchers. It can either be a minor activity or a complex relationship chain. Thus, the definition of logistics would mean a large area of possibilities.

In this study, a port is "a facility, which can receive ships and transfer cargo. The facility includes the container terminal, which is required to conduct the transshipment between ships and land vehicles." This definition is chosen as this study is concerned about the actual seaports and the container terminals in their immediate vicinity. Also, only the flow of actual goods is in the area of interest, not the flow of information.

Ports can be categorized to belong to a larger group called terminal systems. Seaports are terminal systems with a maritime container terminal. Terminal systems might also include inland ports, which do not have access to water. When one discusses about the demand for a terminal system with a maritime container terminal, it can also be seen as discussing about the demand of a port. As the capacity of the container terminal impacts the rate at which the berths can serve the customers, their demand is also an important factor in the total capacity of the ports.

3. System dynamics

SD was developed by Jay Forrester in the late 1950s. The first published work was “Industrial Dynamics” (Forrester 1958) and the simulation model consisted of a supply chain. SD is part of a larger school of thought, systems thinking. Systems thinking studies dynamic complexity. In dynamic complexity is seen to arise from the non-linear and multi-loop feedbacks while in detailed complexity the complexity derives from a wide array of possibilities (Maani & Maharaj 2004).

SD uses only a couple of different kinds of elements to construct complex models. Nowadays almost all SD programs use a graphical interface where the model can be build by connecting different elements together and writing the actual equations inside the individual elements. The used elements are shown in Figure 1.

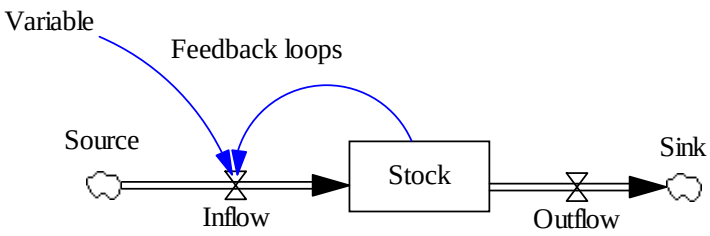


Figure 1. The basic elements in a system dynamic model.

Among the most important elements in a SD model are the stock and flows. The stocks are accumulations which are defined by the in- and out-flows of the model. Mathematically speaking the equations are simply integrals. The stocks play an important part as the model reaches equilibrium as the stocks regulate the feedbacks in the system. For instance, in the example of Figure 1, the stock impacts the values of the in- and outflows so the system reaches equilibrium in time. As the model needs to have fixed boundaries, sinks and sources are used to represent stocks with an infinite capacity. Final parts in SD are variables / parameters and feedbacks. Variables simply store information and / or conduct different calculations during the simulation. The feedbacks represent either a positive or negative feedback, e.g. it will either have a positive correlation between the elements or a negative one. (Sterman 2000)

SD has been used in a wide area of applications. These include ecology, economics, supply chain management, urban development, and even world development. SD has also been used earlier in studying seaports. Munitic et al. (2003) created a SD model where they

studied the material flows in a whole port cargo system. The model was constructed on a micro-level and it contained individual fork-lift trucks, wagons, wharfs, etc. Sanders et al. (2007), on the other hand, studied the investment dynamics in larger port systems including hinterland capacity. The model also contained the competition between the different seaports. Lättilä (2009) constructed a macro-level SD model where the focus was on the development of demand in different seaports. The simulation model did not include competition between the different seaports and the demand was imposed on individual seaports using the historical values. Even thought the amount of publications regarding system dynamic simulations of seaports are low, there should be no reasons why SD could not be a valid method in studying the development of seaports.

4. Agent-based modeling and simulations

ABMS is a relatively new paradigm in modeling. However, the roots are back in the late 1940s in the original Von Neumann machines and it was later on developed into cellular automata (Macal & North 2005). In ABMS individual agents make their own decisions and complexity emerges from the interaction between different agents (Bonabeau 2002). The agents might only posses a couple of different rules, but it is not possible to know what the final interaction inside the whole system will be. Thus, only a couple of different rules can induce extremely complex behavior (Reynolds (1987) has shown how it is possible to simulate a flock of birds using only three different rules: separation, alignment, and cohesion).

As agents are used in many different fields, many different ways to classify agents have been presented (Tweedale et al. 2007). Wooldridge & Jennings (1995) have classified agents from a computer science perspective. In their typology agents should posses the following characteristics: autonomy, social ability, reactivity, and pro-activeness. Macal and North (2006), on the other hand, have used a practical modeling perspective and in their opinion agents should contain the following characteristics: identifiable and self-contained, situated, goal-directed, autonomous and self-directed, and flexibility. According to Nwana (1996) the most important categories are: mobility, reasoning model, ideal and primary attributes, role, and hybrids of the previous ones. He studied agents from a software perspective. Shehory (1998) and Hayes-Roth (1995) have also proposed a classification for agents. Schieritz and Milling (2003) conclude that there are no clear agreements about the subject.

ABMS has been used in many different fields of science. These include economics, infrastructure, business and organization dynamics, biology, military, crowds etc. As ABMS is still a relatively new field of modeling, there has not been that much of work on seaports. Henesey (2006) studied how to simulate a container terminal system with multi agent system. Container terminal systems are a major part of seaports and as such the work can be seen to partially simulate a seaport. Govindan et al. (2006) used a geographic information system in conjunction with ABMS principles and studied how to model the security of a seaport. However, they do not study the actual throughput in the seaport. Overall there seems to be almost no studies regarding simulations on seaports using ABMS. However, as ABMS is an extremely flexible modeling method there are no reasons why it could not be used to simulate individual seaports.

5. Methodology

According to Vafidis (2007), studies can be classified using two dimensions. The first one explains whether the study is quantitative or qualitative, while the second dimension comes from the earlier work of Arbnor and Bjerke (1997). According to Arbnor and Bjerke (1997), three different approaches can be defined: analytical, systems, and actors. In analytical approach the approach is purely objective and rational, while in actors approach the study is more subjective.

This study is quantitative by nature as the simulation models are based on mathematical calculations. Even though some parts of the simulation models are totally objective, the construction process depends on the understanding of the whole system. Also, parts of the system cannot be analyzed independently. Thus, the work can be seen to be partially systems based and partially analytical.

The purpose of this study is to study how seaports can be simulated accurately enough without incorporating too much detail in the simulation model. This study uses two approaches to construct separate simulation model and compares the results between the models. The desired output of this study is a comparison between these two alternative simulation methods.

This study is part of a larger study, where the cargo flows in the Gulf of Finland in emergency situations is studied (STOCA-project). The larger study relies on a simulation model so this study will only include simulation models. Part of this study is also build upon

an earlier study, where a simulation model was used to create a forecast for Finnish seaports. Most of the data used in this study has been gathered from public sources. There was no need to gather first hand data as many data sources for Finnish seaports already exist.

6. Simulating a Finnish seaport

In this section it is first shown how to simulate a seaport using SD and after that using ABMS. The seaport simulated is Kotka, one of the largest seaports in Finland. Kotka has been chosen due to its large size and importance in container traffic in Finland. As this study is focused only on general goods cargo, the simulation models will only contain this module. Also, all general goods cargo traffic will be treated as containers, as containerization will most likely increase heavily in the future. Figure 2 shows the imports and exports of Kotka regarding general goods cargo.

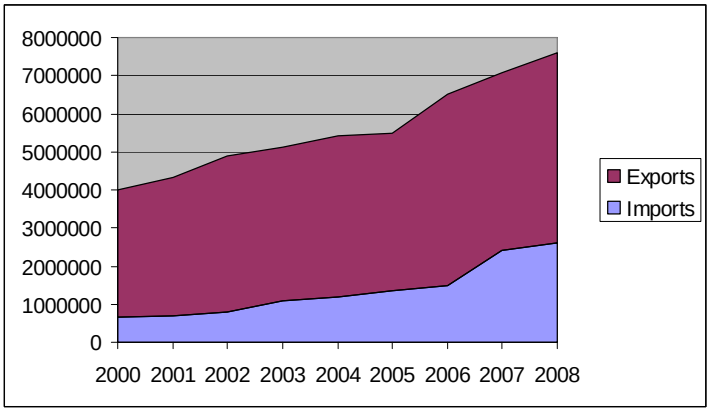


Figure 2. Kotka general goods cargo demand development

As it is possible to notice from Figure 2, the throughput of Kotka seaport has developed significantly during the last years. The global recession, which began in 2008, will impact the demand of Kotka seaport in the near future, but in the used simulation models the demand is assumed to develop steadily as the recession will most likely be relatively short compared to the whole simulation period. The demand is generated in an external module, which is not shown in this paper.

A system dynamic model of Kotka seaport

The SD model used is part of a larger simulation model of Finnish seaports. In this paper only the structure of the seaport is presented and demand is imposed on the seaport. In this simplified example it is assumed that the capability of the seaport does not impact the demand of the seaport, e.g. there is no competition between the seaports.

As the focus of this paper is on the capability of the seaport, the most important characteristics are the demand and capacity of the seaport. As was stated earlier, the demand is imposed on the seaport from an external source. The generated demand comes from an earlier work of Lättilä (2009), where it was found out that the demand of Finnish seaports can be explained using industrial production and Russian oil exports as explanatory variables. The reader can find out more about the used demand in Lättilä (2009).

The second important characteristics, capacity, has been estimated by gathering data from Port@Net. Port@Net is a Finnish database which contains data from all of the Finnish seaports. All of the ships which go through a Finnish seaport must write some essential information on the database. This information includes the amount of cargo, type of cargo, arrival and departure time, berth used et cetera.

As the database contains the arrival and departure times, it is possible to calculate how much time a ship spends on the seaport. By calculating the times from all of the ships at the appropriate berths, it is possible to calculate the utilization of the seaport. In the case of Kotka, the average utilization in 2007 was about 37%. As the imposed demand is at maximum about 10 000 thousand tons for the seaport, the current capacity can be calculated by dividing the demand with utilization. In this case, the current capacity is about 27 000 thousand tons per year. However, the seaports do not work 24 hours a day. Finnish seaports tend to work 2 shifts per day, five days a week and one shift during Saturday. This equals to 11 shifts of the possible 21 shifts, so the effective capacity is about 53% of the possible. The initial capacity used in the simulation model is 14 157 thousand tons per year.

In order to make a useable simulation model, the seaport needs to invest in new capacity in order to cope with the increased demand. It would be possible to simplify the model and assume the seaports to invest at the same rate as their demand increases. However, in reality the investments take a long time (might even take years) so in this simulation model the investments come also with a delay. As soon as the utilization is higher than a threshold value, the seaport will invest into additional capacity, which will be added to the capacity after one year. The structure in the simulation model is presented in Figure 3.

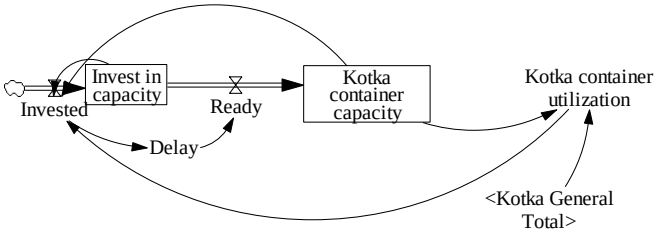


Figure 3. The investments in the simulation model

The actual equation in the "Invested" variable is

(1) MAX((Kotka container utilization - 0.65)×Kotka container capacity×1.1-Invest in capacity,0)

In this example the choice for maximum utilization is 65%. The seaport assumes an increase of 10% in their final demand and takes into account the current investments as well in their investments decisions.

As SD works on aggregated level, it is not easy to incorporate information about individual cases. In this simulation model, it is not possible to simulate each individual sea vessel and calculate their time on queue. However, in this case it is assumed that the seaport is an M/M/1 –system, and using the equations from queuing theory it is possible to calculate both the size of the queue and average waiting times (Tersine 1985).
According to queuing theory, the average size of queue for a stable system is

(2) $L_q = \lambda \times W_q = \lambda^2 / (\mu \times (\mu - \lambda))$

Where L_q = average length of queue

λ = Arrival rate of jobs (in this case, arrival rate of sea vessels)

W_q = Average waiting time in the queue

μ = Service rate of the server (in this case, capacity of the whole system)

In the simulation model λ = "Kotka General Total", and μ = "Kotka container capacity". Now it is possible to create the actual SD model concerning these variables. They are presented in Figure 4.

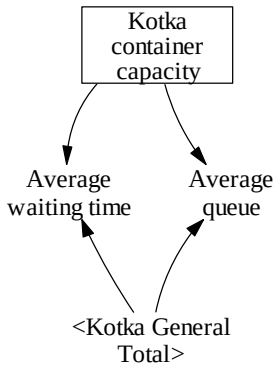
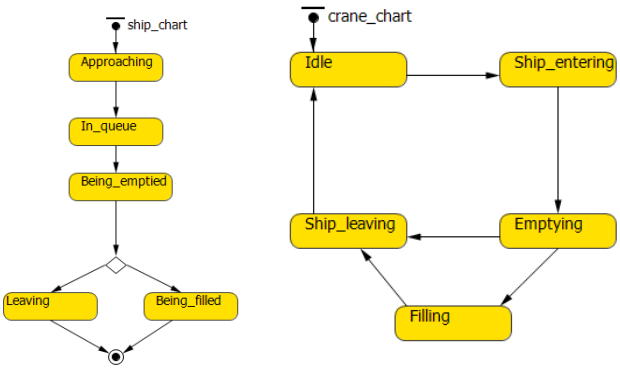


Figure 4. The queuing theory parts of the simulation model.

Overall the SD model requires only a small amount of elements. The whole seaport only contains 10 elements + feedbacks between different parts of the system. The aggregated approach of SD does not fit well the study of queues and waiting times so there needs be other methods used as well. This section has partially answered two of the research questions "*How can a seaport be simulated with reasonable accuracy using system dynamics or agent-based modeling?*" and "*Is it possible to create a simulation model which will calculate the average queues and waiting times at the individual seaports?"*. The other part of these questions will be answered in the next sub-section.

An agent-based model of Kotka seaport

As the basic unit in agent-based modeling is an agent, it offers more degrees of freedom regarding the actual simulation model. In this paper there are going to be two kinds of agents: sea vessels and cranes. Each vessel will arrive at the seaport and go into a queue in order to be processed. If there is a free crane, the ship will move there to be processed. The ships might be either loaded (25% of the cases), unloaded (25% of the cases), or both (50% of the cases). The required work loads average out to 5 thousand tons per ship, which was also used in the SD model. When the vessel has been processed, they will leave the crane and head for their next location. Figure 5 shows the state charts for the sea vessels and cranes.



Figures 5. State charts for the sea vessels and cranes

The seaport contains 8 agents (cranes) with loading/unloading capacities of 387 tons per hour (Mussalo container terminal contains 8 cranes), which is derived from the previously calculated capacity (14 157 thousand tons / (11 shifts / week* 8 hours /shift * 52 weeks) / 8). When the cranes are loading or unloading the ships, randomness has been added so the operating speed in the simulation model is between 194 to 580 tons per hour. A ship arrives on average every 2.23 hours (calculated from the initial total demand 10 000 thousand tons / 5 thousand tons per ship = 2000 ships. 4576 hours in each year / 2000 ships per year = One ship every 2.23 hours) and the time between each arrival is uniformly distributed between -50% to +50%. As the demand will approximately double during 24 years, the average interval will decrease all of the time. After 109824 hours (11 shifts / week×8 hours×52 weeks / year×24 years) the demand will double, which was also the case in the SD model.

The agent-based model does not require queuing theory to calculate the length of the queue and the waiting time as each agent can calculate this by themselves. The values are gathered by the seaport so they can decide how much and when to increase the capacity of the cranes. The investment decision in the agent-based model is similar to the one in the SD model. The seaport uses a moving average from the utilization of the cranes and invests when the utilization rate is higher than 65%. The utilization is checked every 3 months (1056 hour) and the invested amount is the same as in the SD-model. The new capacity will be divided between the cranes evenly.

Overall the agent-based model is more complex to build than the SD model. The SD model contained only 11 elements over all, while the agents need a lot of different kinds of interactions and states to represent the seaport adequately. This section concludes two of the research question "*How can a seaport be simulated with reasonable accuracy using system*

dynamics or agent-based modeling?“ and “*Is it possible to create a simulation model which will calculate the average queues and waiting times at the individual seaports?”*.

7. Results from the simulation model and discussion

The simulation models contain a lot of interesting information regarding the performance of the seaport. The results from the SD model are presented first. The capacity at Kotka seaport increases from the current value of about 14 million tons to 20 – 25 million tons. The utilization of the seaport varies a lot: it can be as low as 40% or as high as almost 100%. It should be noted, that the desired maximum utilization level will most likely impact the overall utilization a lot. The results are shown in Figure 6a and 6b.

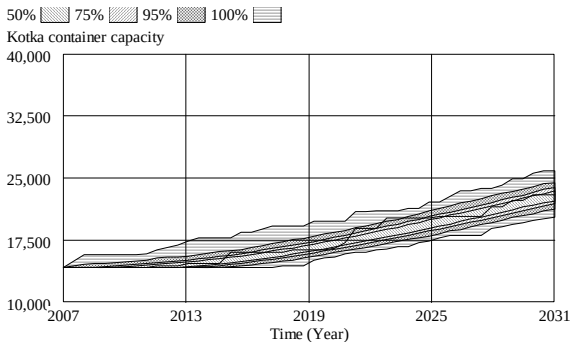


Figure 6a. Container capacity of Kotka in SD in

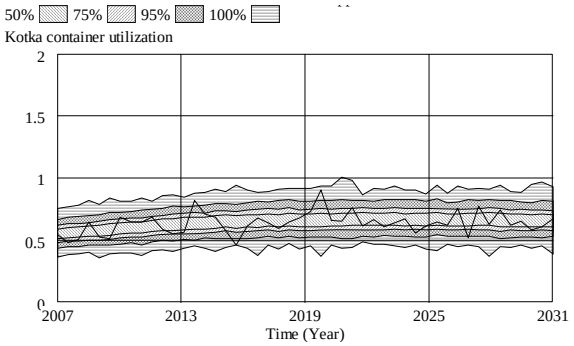


Figure 6b. Utilization of Kotka seaport SD

Figures 7a and 7n show the size of queue and average waiting time at the seaport. The average queue at the seaport is relatively low. In most cases there is only one ship and in over 95% cases the queue is less than 2 ships. In rare occasions the average queue will be higher. The same is true for waiting times as well. In most cases the average waiting time is less than 4 hours, but in rare occasions in might rise to higher values. Again, it should be noted that the desired maximum utilization also impacts these values very heavily.

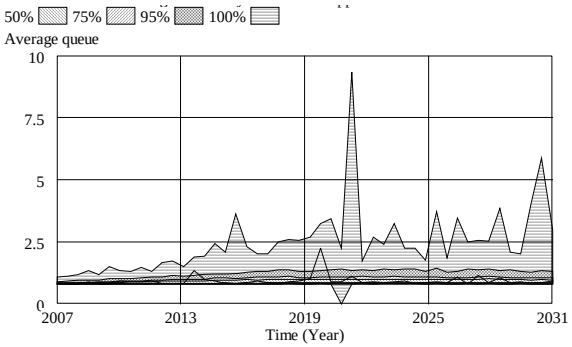


Figure 7a. Average queue at Kotka seaport in SD

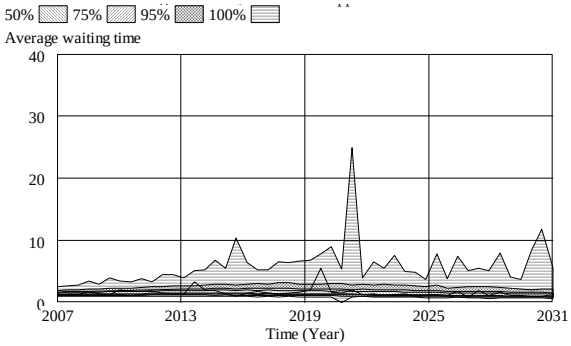


Figure 7b. Average waiting time at Kotka seaport in SD

The SD model gives good insights about the behavior of the Kotka seaport. The simulation model could be used to estimate a desired maximum utilization, after which the seaport would invest to additional capacity in order to cope with the demand. Waiting time can be used as a good indicator for the desired service level. The values are yearly averages, so a high value would indicate extremely long queues from time to time and even with low values there might be long queues rarely.

Results from only one simulation run are presented for the agent-based model. It is possible to construct a Monte Carlo –simulation model for the agent-based model, but the purpose of this paper is to show how to model a seaport, not to study the results per se. First the results for the utilization and capacity are shown in Figures 8 and 9 while the queue and waiting times are shown in Figures 10 and 11.

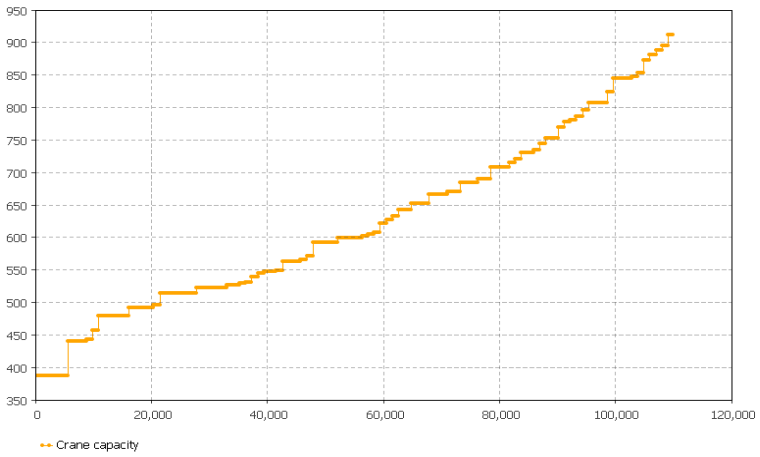


Figure 8. Container capacity of Kotka in ABMS

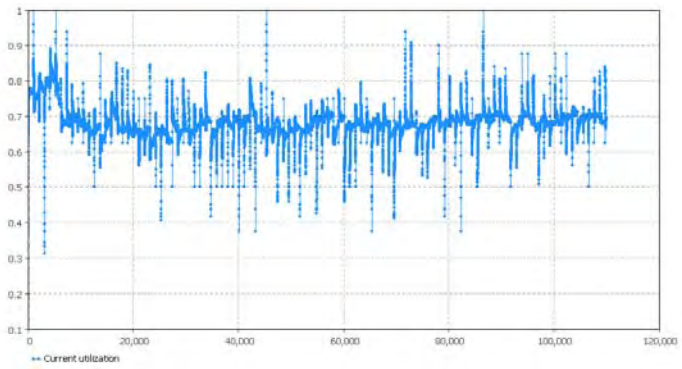


Figure 9. Utilization of Kotka seaport in ABMS

As it is possible to notice from the figures, the capacity of the system is a lot higher than in the SD model. Each crane has a capacity of 915 tons per hour, which is about 4.2 million tons per year. With eight cranes this equals an overall capacity of 33.5 million tons per year, while in the SD model the capacities were 25 million tons per year in the high demand scenarios. The capacity utilization is a little bit less than 70%, which is in the same range as in the SD model.

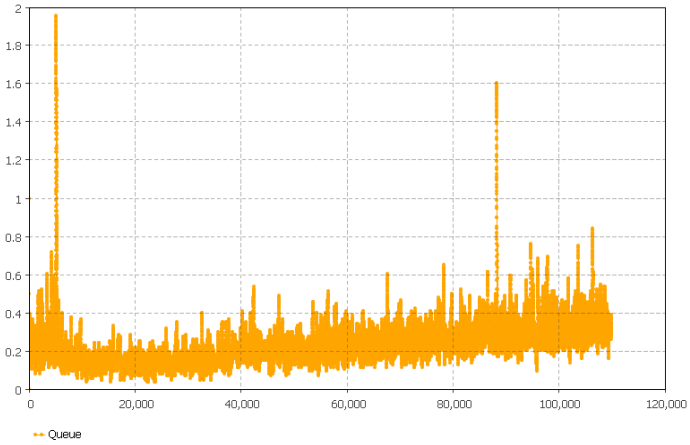


Figure 10. Average queue at Kotka seaport in ABMS

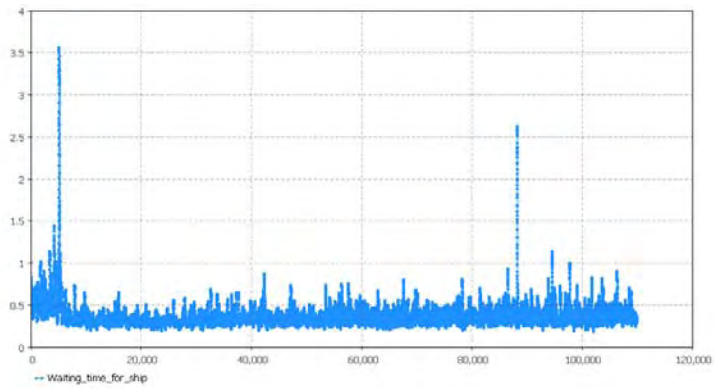


Figure 11. Average waiting time at Kotka seaport in ABMS

The queue in the agent-based model is lower than in the SD-model, averaging only about 0.4 ships at the end of the simulation period. Also, the average waiting time is about 0.4 hours, which is a lot lower than in the SD-model. The desired maximum utilization level will most likely impact very heavily all of these key outputs of the model. Allowing a higher maximum utilization rate it might be possible to achieve similar results with the SD-model. However, all of these results come from one simulation run and more reliable results can be obtained by building a Monte Carlo –module to the simulation model.

The results clearly differ between the simulation models. The agent-based model invests a lot more in new capacity, even though the demand is equally large in both simulation models. One reason might be the additional randomness in the agent-based model or the M/M/1 is not a good system to study a whole seaport.

An SD model about a seaport can be build relatively easy. Only the total demand imposed on individual seaports needs to be generated, but it can be done using time-series analysis or other methods, which, in this case, was done by Lättilä (2009) in an earlier study. The use of queuing theory is based on strong assumptions as it is based on certain statistical distributions. If queuing theory would not have been used, it would have been very difficult to calculate the average waiting times and average length of queue. However, an M/M/1 system might not be the best one to represent a whole seaport. An M/M/8 system would be one possibility, but it would require a lot more complex calculations.

The agent-based model requires a lot more elements and different kinds of events to create a proper simulation model. Again, the demand is imposed on the individual seaports and needs to be simulated separately. The agent-based model can be a lot more versatile than the SD model but there is one major drawback: the simulation model requires a lot more time to run. A single run requires about 60 seconds on a modern laptop, while the SD model can be ran over 15 000 times in the same time. The simulation time can be dropped significantly by decreasing the used time-steps in the model but this will bias the results. This section has provided an answer to the final research question *“What are the advantages and disadvantages of system dynamics and agent-based modeling in simulating seaports?”*.

8. Conclusions

The purpose of this paper was to show how to simulate a seaport using both SD and ABMS. ABMS is a much more versatile approach to simulate seaports and the simulation model does not need to be based on assumptions about different distributions in the simulation model. SD, on the other hand, needs to be used in conjunction with some other methods as well in order to study the service levels of the seaports (in this study it was combined with queuing theory). This would indicate that ABMS is a very suitable method in simulating seaports. The only drawback in using ABMS is a big increase in the actual simulation time. This is not a major issue when running one simulation run but running thousands on runs (such as Monte Carlo – simulation and / or sensitivity analyses) requires a large amount of time. This also makes the potential parameterization of the simulation model difficult.

ABMS is a strong candidate for the further studies of cargo flows in the Gulf of Finland. It can easily incorporate different kinds of seaports both in Finland and Estonia. As the purpose in the larger project is to study emergency situations, ABMS is able to study more complex events (Schieritz and Grössler 2003), while SD might have difficulties in some situations. It should though be noted, that SD is still able to study many different kind of emergency situation but it is not as versatile as ABMS is.

As seaports have not been studied earlier using ABMS, it is not possible to compare the created model with any earlier studies. However, it seems that ABMS is very well suited to studying seaports. There has been some earlier works regarding SD simulations about seaports and this simulation model was relatively simple compared to the others (such as Munitic et al. 2003). As such, it is a lot easier to simulate different seaports in Finland and Estonia with the solution proposed in this paper.

Further studies include the expansion of the current model to emergency situations. In the SD model this can be done by increasing the load on some of the seaports, which are trying to help the malfunctioning seaport. However, this might be difficult if queuing theory is included as it requires the utilization rate to remain under 100% (Tersine 1985). The ABMS model does not have similar assumptions, but it needs to be made sure that the investments are not made according to the emergency situation. Hinterland –logistics should also be incorporated in the emergency situation as there will be some additional pressure to move the emergency amounts inland.

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Establishment of Intermodal transport terminal near Poland-Lithuanian border

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[1]Vilnius Gediminas Technical University, [2]UAB Mockava transport terminal

Abstract
Creating intermodal transport terminal in Mockava, Lithuania will have positive impact on the economical development of this region. The terminal located in the strategic dominant state point and established under the contemporary requirements will provide the needed co-operation with big trading companies and other terminals in the EU, larger Europe and even outside of this area. Transport Corridor No I is very important for Mockava terminal and will have significant impact on the business linked as to the separate regions and to the whole country.

An increase of international transit cargo flows will also be related to the complementary and boosting activities of logistic services associated with the development of Mockava terminal.

Keywords: Terminal**,** logistics, transport, economics, development, cargo

1. Introduction

In order to facilitate international transport operations, the bilateral agreements with neighbouring States are of the utmost importance, especially if the state authorities want to influence the manner in which freight is transported to the hinterland in favour of combined transport.

According to Directives 2001/13/ EB, 2001/14/ EB 2001/12 EC , railway undertakings within the EU shall be granted access on equitable conditions to the infrastructure in other Member States for the purpose of operating international combined transport services.

Transport policy of the EU is oriented towards a more effective employment of railways to reduce traffic load on arterial networks. Joint operation of road and railway transport that is integrated into a uniform transportation system turns to be a sound alternative for cargo handling, ensuring flexible customer service and preventing traffic congestion on roads. In accordance to Lithuanian transport and transit development strategy „National Transport and Transit Development Program“ of 2004, approved by the Government of the Republic of Lithuania (Long Term Plan 2005), the Government prioritizes development of Crete international road and railway transport corridors I and IX. Review of Lithuanian and EU regulations as well as the laws of Lithuanian transport allow concluding the following:

- Establishment of intermodal transport terminal in Mockava unquestionably meets the guidelines of the EU Communication „Intermodality and Intermodal Cargo Transport of May 1997“ (UIRR 1996), since the terminal is intended to effectively use the

potential of the transport corridor I and enables involvement of joint road, railway transport service as well as suggests optimal cargo handling and the place for rendering distribution service **(**Palšaitis, 2005; Palšaitis & Labanauskas 2005; Palšaitis & Sakalys 2006).

- Establishment of Intermodal transport terminal in Mockava would make an essential part of TINA (Transport Infrastructure Needs Assessment) process.

2. Establishment of intermodal transport terminal in Mockava

Intermodal transport terminal will be developed near Lithuanian and Poland border, where together comes 1425 and 1520 gauges. Project will be developed by Achema Group, biggest group of enterprises in Lithuania. To Achema Group belongs about 60 companies within activities in different areas like production of chemical fertilizers logistics, transportation, mass communication, hotels, etc.

1425 wide gauge goes 22 km in to Republic of Lithuania and there are two stations. Mockava station 14 km from Poland border and ends at Sestokai station 8 km track Sestokai - Mockava is equipped with both gauges 1425 and 1530 in one line.

Lithuanian Independence was regained in 1990, after this event, 22 km of Europe standart gauge 1425 from Polish-Lithuanian border to Sestokai became very important. This section became “a window to Europe” for Lithuanian Railway. In 1992 was started carriage of passenger, when was opened traffic Sestokai - Trakiskes (Poland), and carriage of cargo was started in 1994 when was built cargo terminal in Sestoka.

In 1994 a railway station was built in Sestokai. Capacity of the terminal grew up to 0.4 million tones per year. In 1997, after installation of the two 42 t. and third 20 t capacities cranes, station capacity grew up to 0.5 million tones per year. Terminal length is about 350 m and portal route is about 250 m. Terminal expansion possible just to extend to the length due to development of residential district and due to necessary infrastructure support.

Lithuanian international rail transports are mainly east-west direction and north-south direction of transport is a very small part, but has been increasing. The main reason of this is the poor condition of current rail infrastructure. Railway freight transport flows in 2008 showed on Figure 2.

A railway line from the Polish –Lithuanian border to Marjampole is physically and morally obsolete. At the international level, it is a narrow place in highly recognized as a priority Crete corridor.

In section from Trakiski station in Poland to Mockava station in Lithuania the maximum speed of trains is limited in parts to 40 km/h. Mockava station is part of I Pan European transport corridor and Rail Baltica. 15 km to the West is Via Baltica auto road, which connects Helsinki and Warsaw. Every day about two thousands of truck trailers passes Lithuanian-Poland border and Mln. Tons of freight is moving Via Baltica auto road every years. Meanwhile, only 0.5 mln tons of freight per year is conveyed by rail. This is because capacity of existing terminal in Sestokai is too small. Further development is not possible. To increase the amount of freight is necessary to create a new infrastructure.

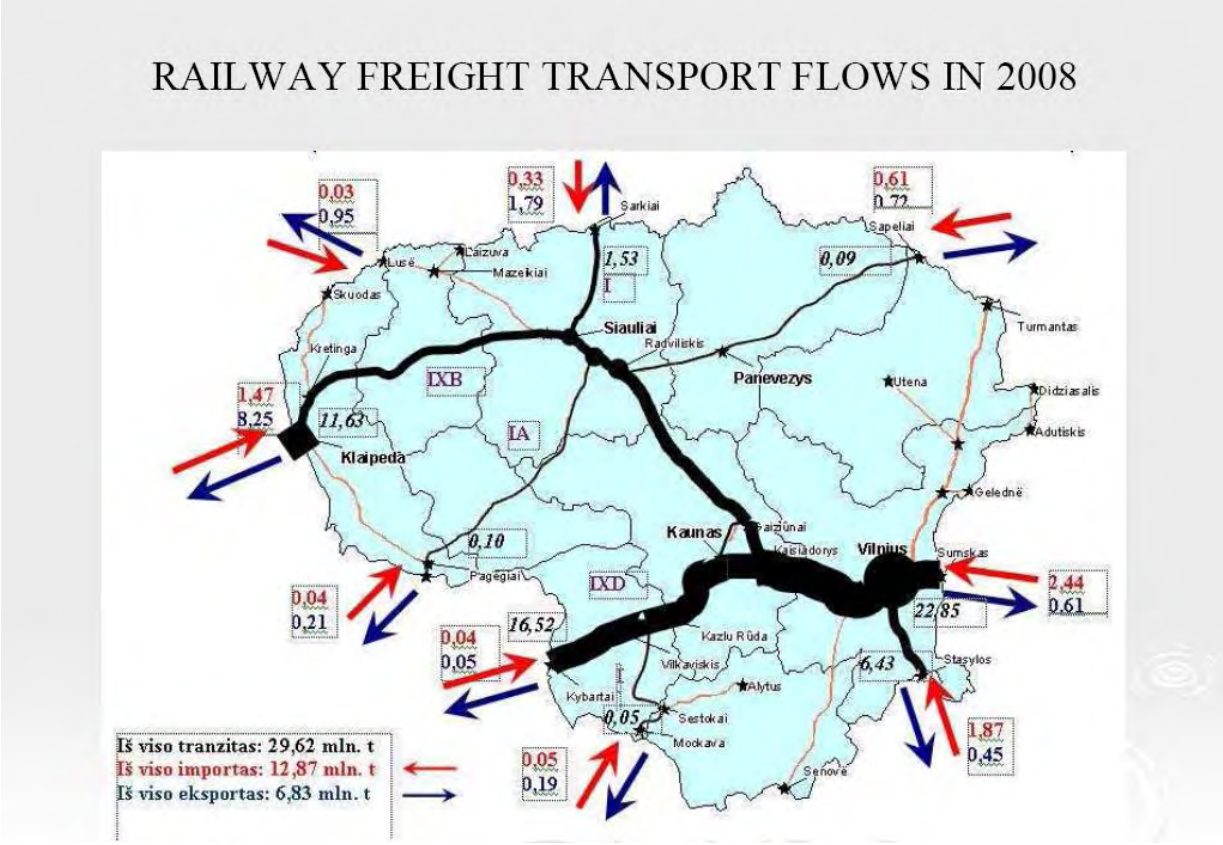

Figure 1. Railway freight transport flows in 2008.

Terminal project will be developed on 40 hectares site. It is foreseen to develop container

reloading facility, reloading wagon to wagon, from wagon to truck and reverse, car reloading terminal, warehouses.

Freight at Mockava terminal will be from Lithuanian enterprises. Import – export and transit North-South and West-East direction. In general export from Lithuania will be chemical manure. With our partners we are developing container train from Tallinn (Muuga port) – to Mockava (reloading) – Warsaw and farther to the west, direction Austria. Direction west-east freight in wagon from Italy, Germany through Poland, with warehousing, reloading at Mockava and to St. Petersburg, Moscow, Kazakhstan and to other Asian countries.

We are considering possibility to develop terminal for semitrailers and gauge change system as well.

The biggest Lithuanian producers and forwarding companies are interesting and waiting for this terminal. Lithuanian companies “Arijus”, “Autoverslas”, “Logipolija”, “Vilteda” (Polzug partner in Lithuania), international forwarder companies - Schenker, DHL, and Kuhne+Nagel confirmed at the meetings, that are going to use services of this terminal and advice what services and operation should be provided at this terminal. “Lithuanian Railways” is interestimg in this project too, at the moment they have a monopoly rail carrier’s right.

We have interviewed biggest Lithuanian production and forwarding companies and made comparative calculations by the parallel terminals in others countries, was found out that designed amount of reloaded cargo may reach 1 mln t per year. Cargo potential for Mockava terminal-general cargo, bulk cargo and motor vehicles.

The biggest Lithuanian producers’ products export to EU via cargo reloading terminal in Branievo, Kaliningrad region or transit via Belarus and reload in Poland. In this way goods carried between European Union members must be shipped through third countries such as Russia (Kaliningrad region) or Belarus territory. That is why these must have customs procedures completed in the journey, and it extended the duration of journey, and wagon park turnaround decreases.

At the interview the biggest exporter of fertilizers said, that done comparison of freight prices in the Central and Western European countries. Currently the cost of transportation by road is lower than by railway. But they hope when this terminal will be opened, operator will find the opportunity to reduce transportation costs. Prices of road transport services for import amounted to 30% more than for export. This situation becomes in larger magnitude of goods in transit, import to Russia; it should be noted that there does not exist almost no export from

Russia. When price level by road transport is alreadt low to Central and Western Europe, then railway services prices going be unhealthy. There exist several ways to solve this problem:

1. To develop a consortium based on Mockava terminal, to provide application for the Marco Polo II program for reception of the grant.
2. To integrate Mockava terminal into currently railway terminals system in Europe and Russia, and develop shuttle trains between the terminals.

Lithuania has good experience from shuttle trains. Container train “Vikingas” operates between Klaipeda (Lithuania) and Iljichovsk (Ukraine). This project involves Lithuanian, Belarusian and Ukrainian railways.

As possible counterparts of Mockava intermodal terminal in Central and Eastern Europe, terminal regions each comprising several intermodal terminals rather than individual terminals have been determined. The following criteria have been applied:

1. Cargo potential in the catchment area of terminals
2. Interconnections to service networks of other intermodal operators
3. Availability of high standard intermodal terminal infrastructure.

Based on these criteria the following terminal regions are the most relevant for intermodal traffic from and to “Mockava terminal”: Moscow, Tallin, Riga, Warszaw, Gliwice, Budapest, Vienna/Bratislava, Wels, Prague, Munich, Ludwigshafen/Mannheim, Rhine-Ruhr, Basel, Milano/Novara, and Verona.

Engineers-designers will have to address the complex challenges related to the two different widths of gauge, trains directly entry to terminal from trunk roads technological and organizational issues. Many design issues of this terminal in Lithuania are going be solved for the first time. In operations we need to install modern computer programs, related to wagons, containers and cargo movement, and accounting. To use these programs, will be needed high qualified specialists.

Construction work is planned to start in 2010 during the first quarter. Investment calculations showed that investment in the terminal during the first two years will reach about 50 mln. Euro, of which about 40 million must be used within the first year of construction. If to use only private investment funds, then payback of this project becomes long and very unattractive for private business. To make a project more attractive is necessary partial financial support from the national funds or from the EU. In the current economic situation Lithuanian government is reduced to the minimum investment programs, and fails to provide even the lowest financial assistance for this project. Started “Mockava terminal” designed works will undoubtedly have an impact on the Rail Baltica Road (Fig. 2).

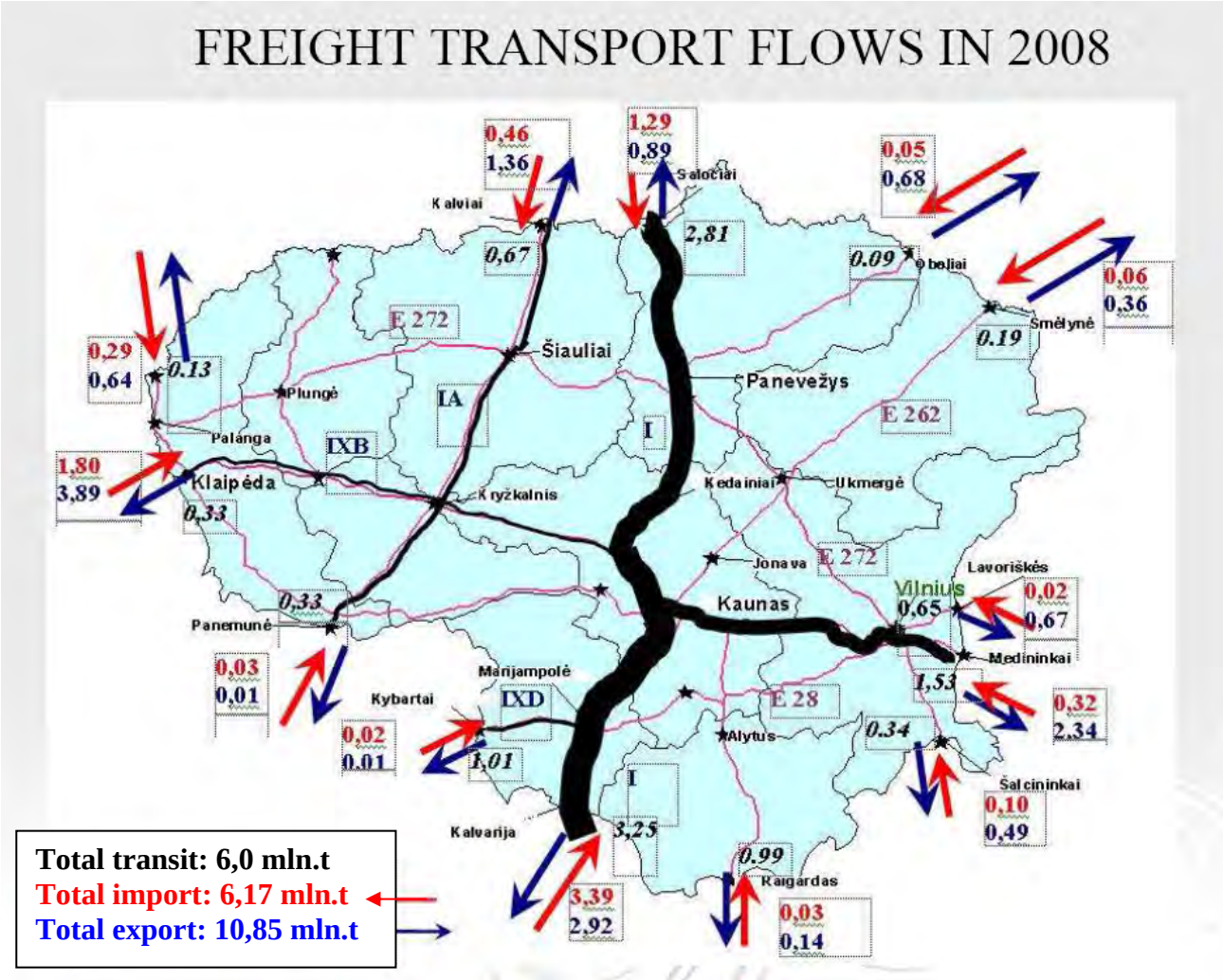

Figure 2. Road freight transport flows in 2008

New route will be much closer to Mockava station, so in future trains could arrive and depart through new railway by much more higher speed, then now, as current infrastructure do not allow use higher speeds.

The emergence of this terminal will undoubtedly have a significant impact not only on Lithuanian economic, but also on Baltic Sea region in social, economic and political aspects.

3. Conclusions

It is necessary to foresee relevant place for dislocation of intermodal transport terminal, its productive capacity and sequence of development. Most important criterion in identification the place of dislocation of transport terminal is the lowering of the total costs.

Establishment of intermodal transport terminal in Mockava will enable to develop companies and their intermodal links, and enhancing activities by combining positive aspects of road and railway transport, and to reduce intensive road traffic in transport corridor I. Also increasing exploitation of loading capacities of different transport implements and relocating part of cargo onto railway benefits transportation system overall.

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Loading-unloading areas of warehouses in the logistic chains

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Abstract
Unloading areas are not independent facilities in the transport nets or supply chains. They are integral parts of warehouses that material flows go through on their way from manufacturers to the end consumers. Their role however in the logistic chains is special, because over them warehouses and transport links cooperate. Therefore these components of the logistic chains are very important for the whole effectiveness of the delivery process of cargo. These facilities influence on efficiency of work both – transport and warehouses. Their projecting sometimes is underestimated and considered as very simple procedure. Some configurations and methods of calculations of loading-discharging docks are displayed in this article.

Keywords: Logistic Chain, Supply Chain, Material flow, Dock, Loading, Cargo, Reception, Unloading, Shipping, Transport, Warehouse

1. Introduction

For a warehouse the loading or unloading docks are just some of the several areas – along with storage area, cargo reception site, places for temporary storage cargo prepared for shipping etc. Sometimes loading and unloading docks are considered even as some separate areas without mentions that they are parts of some bigger systems – such as Logistics or Distribution Centers. So, in Russia, for example, transport specialists call the loading docks just “loading-unloading fronts” and do not want to know some else about them more then only length of these “fronts” and time of railway cars demurrage. In reality, however, these areas of course are not just fronts or lines, but technical objects, having their special performance, configuration, parameters and way of operation. From the whole cost of warehouse building cost of loading-unloading areas is about 5-20% - depending on the types of warehouses. So, as to create efficient loading area it is necessary to consider possible options of their performance, produce parameters description, calculation and optimization.

2. Railway loading-unloading docks

Performance of loading-unloading docks depends first of all on mode of transport of arrival and dispatch of cargoes from the warehouse.

As for railway docks, it is necessary to take into account requirements of Russian GOST (Code) 9238-83 concerning the dimensions of proximity constructions and erections to the railway track. These minimal dimensions are shown on Figure 1.

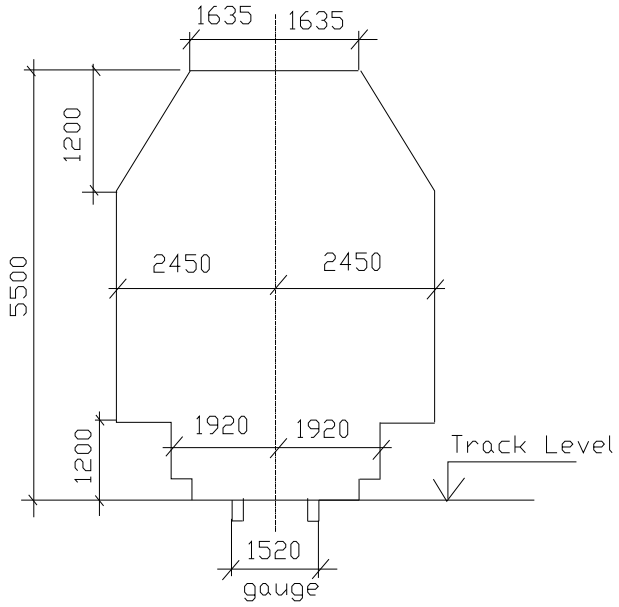

Figure 1. Minimal dimensions of proximity constructions to railway track according to Russian Code.

No stationary device or construction is permitted to be located closer to the track or to be inside of this space.

The railway track can approach a warehouse in various ways. Main of these ways are shown in the Figure 2.

On this Figure picture 2a displays the case of the railway track going outside along the warehouse. On the picture 2b it enters inside the warehouse building. There may be a case, shown on the picture 2c, where the track is situated in the distance of 100-200 m from the warehouse building. This case may be feasible when there is no room or possibility under special conditions of layout to lay the railway track nearer to the warehouse facility.

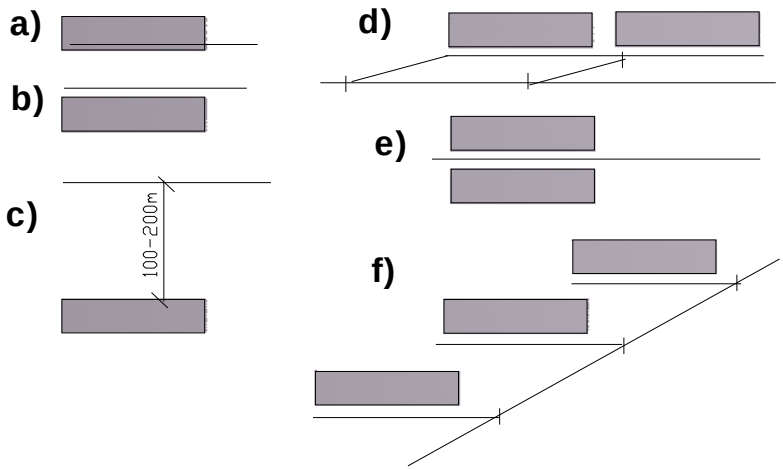

Figure 2. Some typical cases of railway track approaching warehouse building.

On the pictures 2d-2f some cases of the railway track approaching to a few warehouses are disclosed. These cases depend on warehouses disposition on the facility site and the track itself approach to the site. A lot of factors should be taken into account in all these cases while selecting the best solution. Some of them are following: saving of land lot, efficient loading-unloading technology, and suitable railway cars moving to and from the conjunction station to the warehouse facility and so on.

Performance and technical solutions for railway loading-unloading docks also can be various and bring to different technical and economical results. Main typical technical decisions of them are shown in Figure 3.

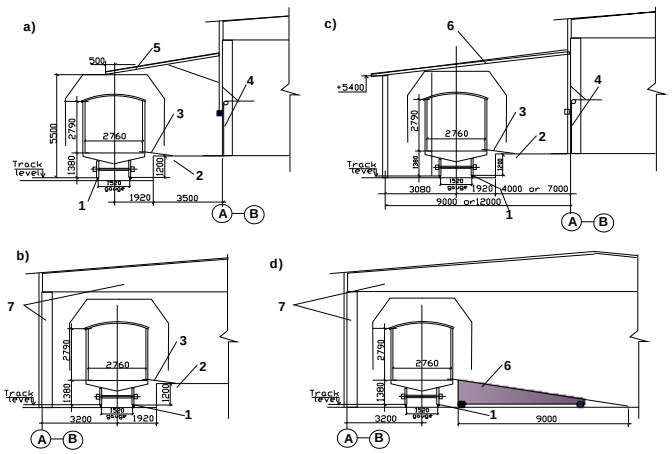

Figure 3. Typical technical decisions on railway loading-unloading docks: with outside railway track (a), inside track within warehouse building (b), half-closed outside railway track (c), inside railway track within warehouse without ramp(d). Legend for the Figure 3: 1 – railway tracks, 2 – loading ramps, 3 – levelers for forklift trucks, 4 – lifting panel doors, 5 –canopy over docks, 6 –

shed covers over docks with supporting columns, 7 – warehouse building, 8 – moving ramp.

Advantages of the first configuration in the picture 3a: low cost, big warehouse capacity (because in this case loading-unloading dock does not take away storage volume inside warehouse building). Drawbacks of this configuration: feasibility of weather and other environment conditions to influence on cargo, personal and handling equipment, bigger land needed for the warehouse.

The variant, represented in Figure 3b, shows technical decision with railway track disposition inside the warehouse building. In this case cargo, peoples and handling equipment are well protected from bad weather environment and warehouse itself - from penetrating unauthorized people inside it without any additional measures. This solution however is the most expensive, because the railway track occupies stripe of about 6 m width along the whole length, i.e. sometimes up to 25-30% of the warehouse area.

The third possible railway loading-unloading dock configuration, shown on the Figure 3c, represents some intermediate solution between the two options having been considered. In this case the dock is located outside the warehouse building, but is covered with shed. Therefore, cargo, people and mechanical handling equipment are protected from unfriendly environment and at the same time this dock configuration is much cheaper in comparison with entering the track inside the warehouse. So, as to understand this it is enough to remind that cost of 1 sq.m of closed warehouse in Russia is something like $600 and shed with loading ramp – about only $150.

The picture in Figure 3d represent one more option – for the case when the warehouse floor is located almost at the same level as the railway track i.e. there is no loading ramp at all. This case may be possible when some industrial building was adjusted for warehouse facility. This certainly is the most unsuitable case, because loading and discharging are fulfilled very inefficiently. So as to overcome this drawback moving apparel is used, or local stationary ramp is erected.

Main parameters which the railway loading-unloading docks are characterized are as follows:

Q – annual throughput; $\mathbf{Q_1}$ - throughput per a day; **L** – length of the track and/or the dock; **m** – number of railway cars, that can be set simultaneously for loading-unloading operations (this parameter is called in Russia “front of loading-unloading”); **B** – width of ramp; **q** – weight of cargo in a railway car**; n** – number of cargo items in a railway car; **M** – number of

loaded pallets in a railway car; **G -** weight of a loaded pallet; **N** – number of railway cars, arriving or dis-patching per a day; **k** – factor of material flow irregularity**; r** - number of loading/unloading machines**; t** – time of railway cars loading or unloading (demurrage); **T** – duration of dock work per a day; p – number of workers, taking part in loading/unloading operations; **C** -cost of loading/unloading of 1 t, 1 pallet and 1 railway car; **K** – whole investment for railway dock building and equipment; **E** – operational cost of the railway dock activity and some others.

Parameters of receiving and shipping areas are not considered here because although they are connected with docks with cargo processing, but are special areas of warehouse and therefore should be researched separately.

For suitable calculation of railway dock parameters it is useful to know also distributions of probabilities of stochastic values, that feature some railway dock characteristics, for example – daily throughput or number of railway cars, which come for loading-unloading:

$$\mathbf{N} = \begin{Bmatrix} \mathbf{N_1} & \mathbf{N_2} \ldots & \mathbf{N_n} \\ \mathbf{P_1} & \mathbf{P_2} \ldots & \mathbf{P_n} \end{Bmatrix},$$

where $\mathbf{N_1}, \mathbf{N_2}, \ldots, \mathbf{N_n}$ - possible number of railway cars, which come for loading-unloading per a day;

$\mathbf{P_1}, \mathbf{P_2}, \ldots, \mathbf{P_n}$ - conforming probabilities of these events.

In some calculations this distribution may be replaced by mean value (mathematical expectation) of the valuables having been considered:

$$\mathbf{Q} = \sum \mathbf{Q_i} * \mathbf{P_i},$$

where **Q** – material flow through the loading-unloading dock daily;

$\mathbf{Q_i}$ – casual i-value of the daily material flow;

$\mathbf{P_i}$ - conforming probability of i-value of the daily material flow.

All mentioned parameters are connected with one another by the following expressions:

Recounting daily material flow:

$$\mathbf{Q_1 = Q*k/T} \quad \text{or} \quad \mathbf{Q_1} = \frac{k}{T} * \sum_{i=1}^{T} Q_i \quad \text{or} \quad \mathbf{Q_1 = q*\sum N_i * P_i +} \sqrt{D(Q_1)}\ \mathbf{;}$$

Length of the railway track and loading-unloading dock itself:

$$L = \frac{15}{x} * \left[\sum N_i * P_i + \frac{1}{q} * \sqrt{D(Q_1)} \right];$$

Number of railway car that can be set simultaneously at the rail dock for loading or discharging:

$$\mathbf{m} = \frac{Q_1}{x * q} \quad \text{or} \quad \mathbf{m} = \frac{1}{x * q} * \left[\sum Q_i * P_i + \sqrt{D(Q_i)} \right];$$

Number of forklift trucks for the railway cars loading-unloading:

$$\mathbf{r} = \frac{3 * q}{G * 60 * t} * \left[\sum N_i * P_i + \sqrt{D(N)} \right];$$

Number of workers (when cargo is coming without of pallets):

$$\mathbf{p} = \frac{0.5}{7} * \left[q * \sum N_i * P_i + \sqrt{D(Q_1)} \right];$$

Investment for the loading-unloading dock building and equipping:

$$\mathbf{K} = \frac{(300 + \gamma * 600 * B)}{x} * \left[\sum N_i * P_i + \frac{1}{q} * \sqrt{D(Q_1)} \right] + \frac{3 * q}{G * 60 * t} * \sum N_i * P_i \ .$$

These formulas can be used not only for calculation while projecting the warehouse and its loading-unloading docks, but also for their research and parameters computation during warehouses simulations.

3. Truck loading-unloading docks

Lorry loading-unloading docks are quite different from the railway ones as by performance, so and by parameters and methods of calculations.

Some typical views of these are shown on Figure 4.

Legend for this Figure

1 – Lifting panel door of warehouse; 2 – Resilient hermetic pillow around the door; 3 – The warehouse wall; 4 – Dock leveler; 5 – Loading-unloading direction; 6 – Cargo ramp; 7 – Warehouse gate; 8 – Protrusion of the ramp; 9 – recession in the ramp/

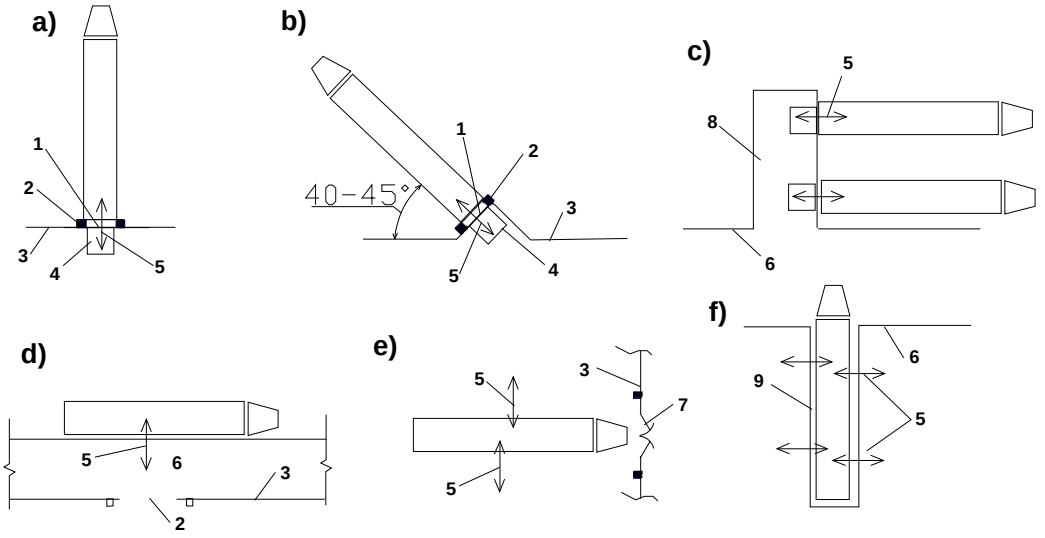

Figure 4. Typical cases of trucks approaching to the loading-unloading dock of a warehouse: Flush dock (a), staggered dock (b), dock with protruding ramp (c), dock with lateral truck approach (d), inside dock within warehouse (e), outer or inside dock with recession in ramp (f)

In the all cases the truck loading ramp are erected of 1200 mm high. The advantages of Figure 4a dock solution (the most often used):

- Full protection of cargo, people and handling equipment from weather conditions;
- Small length of the dock front (berth for every truck takes only 4m of the ramp length).

Drawback of flush dock is large width of driveway to the warehouse (about 35-40 m for high-duty trucks). This solution may be applied mostly when a new warehouse has to be built and when dimensions of the land lot allow wide roads within the facility site.

When there are no possibilities to arrange wide drives according to layout conditions the option with staggered ramp (finger dock) shown on the Figure 4b can be used that allow to lessen the truck apron depth down to 20-25 m. In this case trucks come to the dock ramp with the angle of 40-45º. The disadvantages of this solution:

- Complex configuration and big cost of the saw-like ramp construction;
- More long ramp as comparing with the last case (because in this case berth for every truck occupies about 7 m of the ramp length instead of 4 m);
- More difficult maneuverability of the truck to reach the berth at the dock ramp.

Figure 4c displays the case when it is impossible to arrange cargo ramp along the length of a warehouse and provide driveway to reach it. In this case additional cross protruding ramp may be erected. This may be considered as constrained solution that usually does not allow providing many loading-unloading berths at the warehouse dock. Another drawback of this option is impossibility to organize one-way movement of truck around the warehouse.

Open-top trucks often require to be discharged in directions of lateral sides and not only by forklifts, but also with overheard cranes. Feasible configurations of loading-unloading docks for these cases are shown in Figures 4d, 4e, 4f. Such open-top trucks may be set for the freight operation with their lateral side along the cargo ramp (Figure 4d), inside the warehouse (for example under crane (Figure 4e) or in a recession in ramp, that may be arranged outside or inside the warehouse (Figure 4f).

All these options of loading-unloading dock configurations may be considered depending upon the project conditions and the warehouse facility layout. Performance of truck loading-unloading docks may be better considered in elevation view as shown in Figure 5.

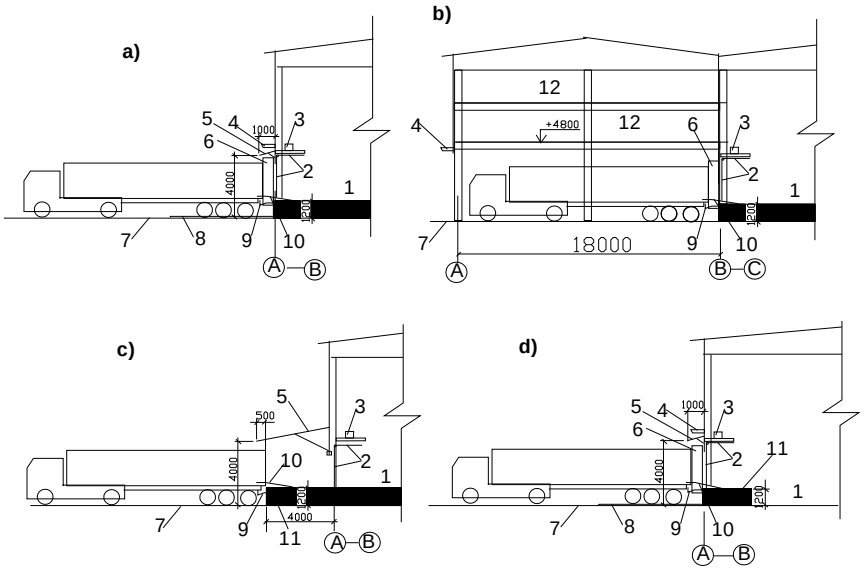

Figure 5. Typical configurations of warehouses loading-unloading docks. (a) Without external ramp. (b) With truck entering inside the warehouse building under office premises. (c) With external ramp. (d) With inside local ramp.

Legend for the Figure 5 (the same for the all 4 pictures of it):

1 – Reception or staging area of the warehouse; 2 - Panel door; 3 - Door-heater on a mezzanine; 4 – Canopy over the dock; 5 – Signal light; 6 - Resilient seal cushion around the

door; 7 – Driveway pavement; 8 – Truck-directing devices; 9 – Truck restraint device; 10 - Dock leveler; 11 – Ramps; 12 – Office and other premises.

All these four cases, displayed on the Figure 5, can be applied and met in existent warehouses under different facility conditions.

Advantages of the first configuration, shown in Figure 5a, without external ramp, that explains its most wide applying:

- Big width of driveway for trucks;
- No investment for the ramp building;
- Protection merchandise, dock people and handling equipment of weather conditions;
- Safety of cargo.

Additional advantages of the solution in Figure 5b is using the space over the dock and so decreasing the whole dimensions of the warehouse building. These one or two stores may be used for deployment offices, food service facilities, computer rooms, lavatories and so on.

The configuration in Figure 5c was applied mostly in old warehouse decisions and may be seen at some old warehouses, having been built in 70-80-s of the last century. Its advantage, however, is that the external covered ramp may be used for temporary storage of empty pallets and sometimes even – merchandise, prepared for loading.

The fourth configuration in Figure 5d shows the case of warehouse decision when high bay racking constructions are established direct on the warehouse floor, without lifting it up to 1200 mm over level of outer ground. That allows increasing capacity of the storage area and sometimes receiving one tier more in height. That solution may be enhanced furthermore by erection mezzanine with office and computer rooms over the dock ramp and buffer staging area of the warehouse.

Many parameters which the truck loading-unloading docks are characterized with are like these of the rail dock ones. They are as follows:

Q – annual throughput; $\mathbf{Q_1}$ - throughput per a day; **L** – length of the dock area; **m** – number of truck berths; **B** – width of ramp; **q** – weight of cargo in a truck**; n** – number of cargo items in a truck; **M** – number of loaded pallets in a truck; **G** - weight of a loaded pallet; **N** – number of trucks, arriving or dispatching per a day; **k** – factor of material flow irregularity**; r** - number of handling machines, used at a dock**; t** – time of truck loading or unloading (demurrage); **T** – duration of dock work per a day; p – amount of workers, taking part in loading/unloading operations; **C** –operation cost of loading/unloading of 1 t, 1 pallet and 1

truck; **K** – whole investment for truck dock building and equipment; **E** – operational cost of the truck dock activity and some others.

These parameters are connected with one to another by the math expressions that are mostly alike the parameters of the rail one. These expressions are practically used while warehouses are being projected.

The number of gates is the most impotent parameter of a truck unloading area.

There are two simple analytic methods of truck gates determination at the loading-unloading dock of warehouse.

The first one is based on using of united factor ΔS of warehouse area per one gate. This value is designated as ΔS= 500…1000 sq.m. (depending on stock rotation in warehouse). So number of gates can be determined as:

$$m = S / \Delta S,$$

where S – whole area of the warehouse, sq.m.

Although this method is not quite precise, it can be used on the preprocess stages of warehouse creation.

With the second method the number of truck berths at warehouse can be determined with the equation:

$$m = \frac{(N_1 + N_2) * t}{T},$$

where N_1 - number of loaded trucks, arriving to warehouse per day;

N_2 - number of empty trucks, arriving to warehouse per day for cargo;

t - average duration of the gate occupation by a truck, hours;

T - working hours of trucks loading-unloading during a day.

Values N_1, N_2 and t may be taken in the calculation just as some average ones or, preferably, - as results of some statistic data treatment or even simulation. So, in this case it is possible to take into account stochastic feature of inbound and outbound material flows.

For the purpose of warehouse facilities research, however more precise and suitable methods of simulation should be applied. In Russia the most wide spread systems of technical object simulation are GPSS-World (General Purpose Simulation System-World version) and AnyLogic.

Simulation program GPSS consists mostly of blocks and commands, followed with operands (parameters) which characterize them and determine regulations of the simulation model.

A model for simulation of loading-unloading area of a warehouse can be represented in the follow view:

```
* GPSS World - Simulation model Vorota
*
GENERATE     150,30    ;Create next truck
QUEUE        Vorota    ;Begin queue time
SEIZE        Vorota    ;Own or wait for gate free
DEPART       Vorota    ;End queue time
ADVANCE      120,40    ;Time of truck discharging
RELEASE      Vorota    ;Discharging done. Give up the gate
TERMINATE    1         ;Truck leaves
```

As can be seen the simulation model GPSS consists of 3 columns:

- Blocks and commands;
- Operands;
- Commentary.

The first two columns form the core of the simulation model. The Commentary column is ignored by the simulation system and included in the model only for some explanations. The word “Vorota” means in Russian “Gates” and included in the simulation model just for understanding by Russian users.

The results of loading-unloading dock simulation are number of truck berths, time of trucks demurrage and about 10 parameters more.(number of trucks, trucks in queue for unloading and so on).

4. Conclusion

In the article main directions on loading-unloading areas of warehouses projecting and research are represented. This information may be useful for those engineers who are interested and eager for reception more specific knowledge on the warehouses detail configuration and processing, including specification of their separate areas.

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Analyzing risks involved in handling oil and chemicals in Estonian Ports

Tõnis Hunt, Nelli Norit & Raivo Portsmuth

Abstract
Tallinn, Paldiski and Sillamäe are the main regions where the ports which handle oil and chemicals are situated. In 2008 about 22 mln tons of oil and oil products and 1.4 mln tons of chemical products were handled in Estonian ports. This is the smallest amount of products in recent years due to economic recession and political factors. Still the amount is big enough to cause serious problems in case of an accident. The aim of the article is to define the risks and analyze the current situation in the field of risk analysis of handling chemicals, oil and oil products. The article includes preliminary results of the analysis of collected data about chemicals and oil cargo flows through Estonian ports, summaries of interviews with specialists from ports and other companies**.**

Keywords: Oil and Oil Products, Chemicals, Ports, Risk, Danger, Accident

1. Introduction

Transportation of goods always has certain risks involved. There are different kinds of risks such as environmental, political, social etc. Their impact on the whole transport process may vary in a large scale from small localized accident to a big international disaster. Realizing the risks and being aware of dangers related with them is important when providing high quality transport service. Taking those into consideration helps to provide service to cargo owners with minimal risks involved. It also simplifies managing of cargo flow moves through different stages of transport chain without complications. Considering aforementioned, it is important to have emergency scenarios for rerouting whole or a part of cargo flows in case of an accident. In order to be feasible, these scenarios should take into consideration some preconditions such as minimal or no extra costs for cargo owners, quality of service, minimal delays, fluent cargo flow etc should be considered.

Definition of the inputs plays significant role for the base of every scenario. This article fulfils this task in the framework of the STOCA project, which is focused on the study of cargo flows in the Gulf of Finland in emergency situations. Firstly, it gives general overview of cargo flows of oil and chemicals through Estonian ports. Secondly, the authors define the risks of dealing with such cargo and analyze the current situation in the field of risk analysis of handling chemicals, oil and oil products.

Information for this article was collected using open databases, statistical data of different companies and interviews with local experts and periodicals of the local press.

2. Overview of cargo flows of oil and chemicals through Estonian ports

From the beginning of 90's, after Estonia regained independence, when the structure of economy needed dramatic changes, also the ports had to change their plans of action. This meant that new cargo flows were introduced, that has kept its dominance up to present-day. While old cargo flows were mainly general cargoes, the new ones were mainly liquid and dry bulk cargoes. This brought up the need for new specialized terminals for handling these flows. Keeping in mind that simultaneously one major trend in logistics is specialization, the terminals that we have in major Estonian ports at present day are highly specialized, and there are modern terminals for handling oil and oil products, coal, fertilizer, containers, cars, chemicals etc.

Main commodities within oil and chemicals cargo flows are oil and oil products as liquid cargoes and fertilizers as solid bulk cargoes (Figure 1). Port of Sillamäe, which started operating in 2005, has introduced new cargo flows – liquid chemicals (Port of Sillamäe 2009a). At the moment the share of this cargo is not very big. Altogether oil and chemicals form big share of total cargo flows, making 64,5% (23,4 mln t) in 2008. In past nine years the share of oil and chemicals has been between 61% and 70%.

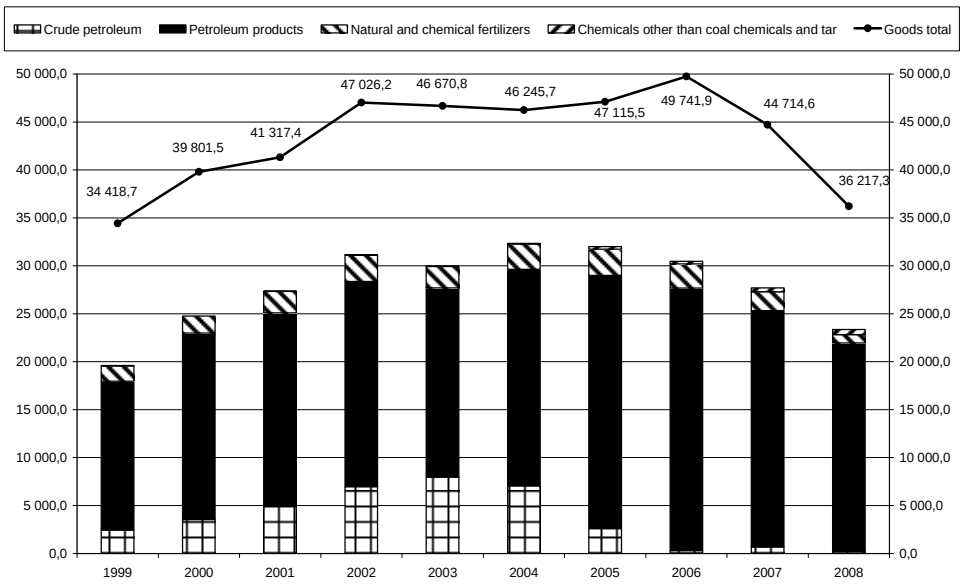

Figure 1. Transport of oil and chemicals (thousand tons) through Estonian ports 1999-2008. (Source: Statistics Estonia 2009)

Transit cargo share amongst oil and chemicals cargo flows is considerably higher compared to other cargo flows (Figure 2). If chemicals, oil and oil products have transit cargo share averagely 81%, 99% and 100% respectively, then containerized goods, goods on trailers and wood transit share is averagely 24%, 1% and 1,3% respectively making total goods transit share 74%. As seen on the figure below, transit cargo share has dropped from 78% in 2006 to 68% in 2008. The reason for that is political, not economical.

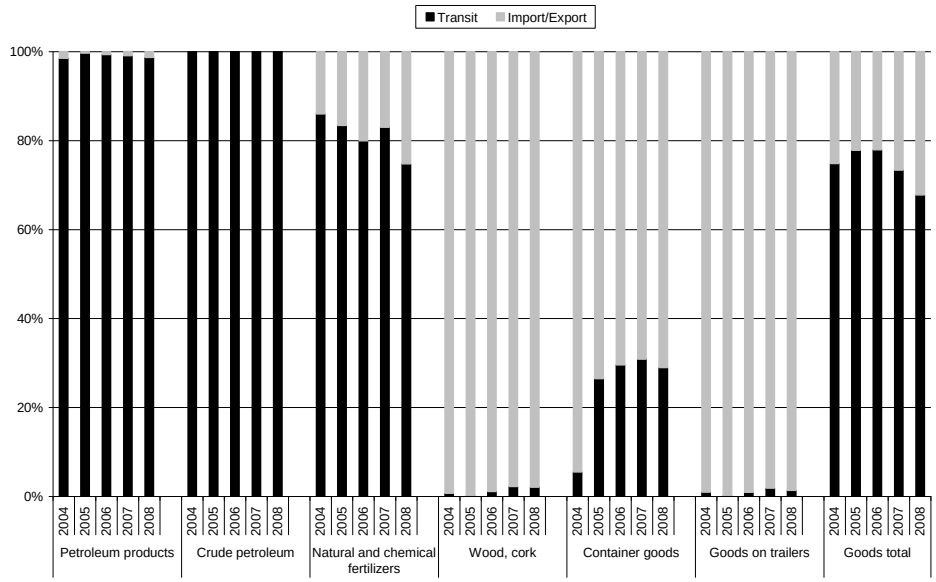

Figure 2. Transit cargo share of different cargo flows handled in Estonian ports 2004-2008 (Source: Statistics Estonia 2009)

Though there have been different developments on economical and political level, in recent years oil products have been playing most important role in ports cargo throughput during the whole period of research. With harsh economical decline, oil products share rose from 42% in 2003 up to 60% in 2008, although throughput fell from 27.3 mln tons in 2006 to 21.7 mln tons in 2008. Throughput of crude oil reached its peak in 2005 when 7.96 mln tons of cargo were handled. In 2008 only 0.23 mln tons were handled. Last two years have shown a big decline amongst companies while handling fertilizers, dropping from 2.75 mln tons in 2006 to 0.86 mln tons in 2008. Before that amount of fertilizers varied from 2.2 to 2.75 mln tons between 2001 and 2006. (Statistics Estonia 2009)

3. Ports handling chemicals, oil and oil products

From the geographical point of view all the ports which handle chemicals, oil and oil products are situated on the northern coast of Estonia in three regions (Figure 3): Sillamäe (Port of Sillamäe), Tallinn (Port of Tallinn – Muuga Harbour, Paljassaare Harbour, Port of Miiduranna and Port of Vene-Balti) and Paldiski (Port of Tallinn – Paldiski South Harbour). All mentioned ports are handling chemicals and/or oil at the present. The role of Paljassaare's harbour is marginal nowadays. There are ports (e.g. Paldiski North Harbour) that had handled these cargo flows but not at the present. Although they are situated in the same region.

Figure 3. Map of the Northern Estonia (Source: Estonian Land Board 2009)

From the point of view of transportation we can divide ports based on railway station servicing them (Smiltinš 2007):

- Maardu(–Muuga) – servicing Muuga Harbour;
- Ülemiste(–Kopli) – servicing ports in Kopli peninsula (Vene-Balti, Paljassaare) and Paldiski peninsula (Paldiski South Harbour and Paldiski North Harbour);
- Vaivara – servicing port of Sillamäe.

All cargo trains, which are directed to Tallinn and Paldiski region, go through populated areas and prefigure potential hazard in case of an accident. The most critical is the situation with trains passing through Kopli station, because it is situated in densely populated areas (Figure 3). There have been plans and researches on governmental level (Deloitte & Touche Eesti AS 2006 (orderer Port of Tallinn)) to build Tallinn re-route for trains going to Paldiski, but there are many problems to be solved – availability of land, ecological impact, cost of re-route, legal issues etc. So far the plans have stayed on paper.

But not only full cargo trains prefigure danger. Also, storage facilities full of oil and chemicals and transshipment process are potentially dangerous. Oil terminals tank park in

Muuga harbour comprises 1,1 mln m^3, in Paldiski South harbour 260 th m^3 and in Paljassaare harbour 47.4 th m^3 (Port of Tallinn 2009). In Sillamäe the capacity of tanks for oil terminal is 292.5 m^3 (Alexela Sillamäe 2009), for different liquid chemicals 155.5 th m^3 (Tankchem 2009, Port of Sillamäe 2009b). Muuga harbour has storage facilities for dry fertilizers in amount of 165 th tons (Dry Bulk Terminal 2009).

Many of the storage facilities are situated in the vicinity of urban areas. Good example of this is port of Miiduranna (figure 4), which is surrounded by lots of dwellings in the vicinity of 1000 m. Similar situation is near other ports in the Tallinn region and in Paldiski. In Sillamäe urban area is situated a bit farther.

Figure 4. Nearness of different areas in the port of Miiduranna (Source: Estonian Land Board 2009):
Port area – blue;
Liquid storage facilities – red;
Urban areas in 1000 m vicinity – green.
Note: borders of areas are approximate.

4. Terminals in ports

Almost all cargo ports in Estonia act as landlord ports. So, transshipment activities are carried out by the private operators. There are several terminals offering its services in oil transshipment. In the Port of Tallinn there are Pakterminal, Eurodek, E.O.S., Oiltanking and

Neste in the Muuga harbour, Alexela Terminal and Biodiesel Paldiski in the Paldiski South harbour and Scantrans in Paljassaare harbour (Port of Tallinn 2009). Pakterminal and E.O.S. belong to the company Vopak E.O.S (Vopak E.O.S. 2009). Alexela Terminal belongs to Alexela Logistics which also operates in Sillamäe as Alexela Sillamäe (Alexela Logistics 2009).

In Sillamäe there are two more terminals handling liquid bulk cargo: Tankchem handling liquid chemicals and Baltic Chemical Terminal is handling liquid fertilizers (Port of Sillamäe 2009c).

DBT in Muuga harbour is the biggest dry bulk fertilizer operator in Estonia. Other companies handle dry fertilizers in marginal degree.

5. Defining the risks

Where as the objective of this study was to identify possible risks occurring when transporting dangerous cargoes and rerouting in case of incident, then this part of the article is analyzing the risks dealing with it. Also describing the type and level of severity of accidents and risks encountered as well as making suggestions to the decision makers for safe environment.

The most frequently occurring hazards are those dealing with environmental, political, social aspects. The problem that needs to be solved is how these risks influence cargo flows and what are the consequences.

In the scope of the project we have interviewed specialist, municipal officials and people who have investigated these issues and the findings of interviews were more than alarming.

There have been research projects conducted by the municipalities (e.g Viimsi Vallavalitsus in 2007 ordered from Foronte OÜ) to define the risk however, these have been done from the readiness to accident point of view. These projects have been carried out in order to evaluate environmental problems of dangerous cargo handling and social aspects of having dangerous cargo terminal close to the towns and living areas.

For the past fifteen to twenty years the ports have been developing rapidly. The ports have become landlord ports – they started investing into development of infrastructure and leasing it out with a building title to independent cargo handling companies for a long term conditions.

The main problem discovered was the lack of responsibility by the port and the companies working in the port. Typical ports act as landlord ports and therefore they are not liable for the actions taking place on the port territory, since they are only responsible for the safety in the aquatory.

Although, the legislation for port development is relatively good, there is a problem of descent monitoring on implementing the law. It is the responsibility of the competent authority to identify establishments or groups of establishments, where the likelihood and the possibility or consequences of a major accident may be increased because of the location and the proximity of such establishments, and their inventories of dangerous substances. However, these authorities are lacking the competence to evaluate the environmental impacts and dangers of these establishments as it should be appropriate for the maritime country.

One of the findings of this project was that in Muuga harbour there have been developments of infrastructure for different kind of dangerous cargos (Figure 5). There are different terminals handling oil products, liquid petrochemicals, general cargo and liquid fertilizers. This is very alarming, since it represents hazard for creating damage to human health and/or the environment.

Figure 5. Muuga Harbour (Source: Port of Tallinn, 2006)
1 – Liquid bulk storing and loading/unloading area;
2 – Liquid bulk storing area;
3 – Dry bulk (fertilizer) area;
4 – Liquid bulk loading/unloading area;
5 – Dry bulk (fertilizer) loading/unloading area.

Establishment of storing or handling different dangerous cargos can lead to an accident such as a major emission, fire, or explosion of any establishment and can lead to serious danger to human health and/or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances.

Because the accident of one establishment can cause the fire or explosion of another, it can cause the domino effect. In order to reduce the risk of domino effects, there should be provision for the exchange of appropriate information and cooperation on public information. (Council Directive 96/82/EC 1996)

In the risk assessment carried out by the Fire and Rescue Board they calculated the outer border of danger area for the incident involved with oil, oil products and fertilizer carried by train, truck or ship as well as incidents happening in Muuga Harbour. (Foronte OÜ 2007). From the assessment it was shown that in case of possible incident with fertilizers on port territory the outer limit of danger area was 5000 m. This however, will reach the town situated close to the port. In addition, there were calculations done to identify the outer border of danger area in case of explosion of one railway carriage carrying these fertilizers and the results showed that the outer border of danger area was 600 m. However, in case of oil terminal explosion the danger area will reach to 800 m. (Foronte OÜ 2007) Although these explosion areas do not affect the town nearby, the fire and smoke would be in vicinity area. In case of breaking of reefer complex on port territory, the toxic gas could reach up to 1000 m, which would affect the people living nearby. The assessment however, did not investigate what the results will be in case of concatenation of explosions.

For an example there have been at least 3 dangerous incidents happened in Muuga Harbour for the past few years. Last very serious fire was on 14 March 2006 where there was fire in one of the terminals. The incident happened on the fertilizers handling slade. Fire had started from the welding machine. If the fire would have not got under control so fast, the incident might have had more sever consequences. (ERR 2006).

In conclusion, the major problem is the lack of monitoring and implementation of the legislation. Local authorities and municipalities do not have qualified experts to evaluate the dangers rising from the port development and building different establishments too close to each other. To reduce direct danger in ports, local authorities should intensify the monitoring of handling the cargo. Furthermore, authorities should enforce the limitations of concentrating

dangerous cargo and establishing of objects hazardous to environment through licenses, planning affirmations etc.

Due to explosion emergency situation might cause danger to human life and health, properties and the environment might be severely damaged or destroyed. Also, pollution would be endangered due to hazardous chemicals that could get into the air or soil.

6. Conclusion

During the last ten years oil and oil products have been dominant cargo flows handled by Estonian ports. Combining these cargo flows with chemicals (dry and liquid) potentially hazardous situation arises, and in case of an accident the result could be devastating in ecological, social and financial level. Though the cargo flows of chemicals, oil and oil products have declined, the risk of an accident has stayed the same as the routes, which are used for transporting these goods.

Geographically we can define three different regions, where ports handle aforementioned cargo flows – Sillamäe, Tallinn/Muuga and Paldiski. As all the ports in these regions are situated in vicinity of urban areas (about 1000 m or less) handling such cargo flows must be considered very hazardous. The risk of hazard magnifies if more than one dangerous cargo flow is handled. This is the case in Muuga and Sillamäe harbor. In Muuga oil and oil products and dry bulk fertilizers are handled, in Sillamäe oil and oil products and liquid chemicals are handled near each other.

The likelihood of an accident increases for these regions as the railway routes, which are used for supplying ports with cargo, run through densely populated areas. This is especially the case for Tallinn/Muuga area as the railway station, which is used for serving ports in Kopli peninsula and Paldiski region, is located in the centre of Tallinn. Positive fact is that the city has acknowledged potentially hazard situation and has taken steps for solving the problem. Still, the situation with Kopli railway station stays as the research for re-routing cargo flows for Paldiski showed, that there are many obstacles to overcome.

On the one hand, the hazard arises from physical cargo itself. On the other hand, this is questionable whether there is a possibility of minimizing the risk through legislative measures and monitoring. Unfortunately, there are some drawbacks in that. Probably the most

important one is the lack of competence of responsible authorities. As many of these tasks are responsibility of local authority, it often comes to financial reason, which explains the lack of competence. One solution would be cooperation between authorities and, fortunately, there have been done some movements in that direction. Such kind of cooperation must result in researches which outcomes would be a contingency plan. This kind of research should not only be done in cooperation with local authorities but also in cooperation on different levels of state, local authorities, institutions and research institutions.

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Sustainability and multimodal transportation in modern cities – looking for effective relocations in urban areas

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***"When a man rides a long time through wild regions he feels the desire for a city"*[1]**

Abstract
Current cities continuously aspire to ensure the highest quality of urban life and full satisfaction of their users. The increase of the negative effects of using individual transport in the cities contributed to integration of relocation system. An example of such integration is multimodal transportation use in many cities all over the world. This concept which enables use efficiency and effectiveness public transportation system contributes also to sustainability. Multimodal transportation created some model solutions such as Park & Ride, Kiss & Ride and Bike & Ride, which further enable reduction of negative results people relocation in the cities.

Keywords: Multimodal transportation, urban logistics, city, sustainable transportation, multimodality

1. Introduction

A city is an urban area, which is characterized by high intensity of buildings, small agricultural area and people who work beyond agriculture and lead an urban life style. It also has a high population density and a particular administrative, legal and historical status. The city is a collective space which belongs to all those who live in it, who have the right to find there the conditions for their political, social and ecological fulfillment, at the same time assuming duties of solidarity[2].

Italo Calvino[3] thought that people settle in the cities because they need a better communication. Communication usually is perceived as a process of transferring information form one source to another. In urban logistics[4] communication is also perceived as a process of people relocation using different kinds of carriers in the cities.

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[1] I. Calvino (1997) , *Invisible cities*, Vintage, p. 8 Italo Calvino (15 October 1923 – 19 September 1985) was an Italian journalist and writer of short stories and novels. The author of *Invisible Cities* (1972), the most beautiful book, which throws up ideas, allusions, and breathtaking imaginative insights on almost every page.

[2] The European Charter for Safeguarding of Human Rights in the City adopting the stance of the European Charter of Local Autonomy.

[3] (15 October 1923 – 19 September 1985) was an Italian journalist and writer of short stories and novels. The author of Invisible Cities (1972), the most beautiful book, which throws up ideas, allusions, and breathtaking imaginative insights on almost every page.

[4]All processes of management of human, cargos and information flows inside logistics system of the city, accordingly to needs and goals of the city, with respect for natural environment, considering that city is the social organization for which the main goal is satisfying needs its users (J. Szołtysek (2005),.*Logistyczne aspekty*

Unsustainable transportation systems have been the cause of many problems facing urban areas around the world. Lack of regard for sustainable development considerations by those responsible for planning and implementing transportation systems has caused unhealthy air quality, noise pollution, traffic congestion, loss of green spaces and biodiversity, disruption of neighborhoods, equity problems, resource use etc. Many factors could potentially cause unsustainable transportation systems to persist. Transportation planning and decision-making are very crucial in determining the structure and operation of transportation systems and hence its sustainability. The main task of the authorities of the city is an assurance its users the right and well organized communication. People make decisions about their relocation, which aren`t usually reasonable. They choose the way of travelling, which ensures them the highest standard of comfort and don`t limit their freedom. Nowadays people treat possibility of communication as an element of independence because keeping mobility in all periods of their lives is for them very important.

Inhabitants of the city can travel in following ways:

- on foot,
- using individual automobiles,
- using public carriers (public means of transportation).

The first way of travelling is a very profitable solution alike for people and natural environment. Unfortunately people practice it very rarely, because they prefer using individual cars, which are very common.

Using private automobiles has many advantages like convenience of travelling, independence and usually shortened time of travelling. It has also many disadvantages like negative influence on natural environment, a high fuel consumption and ineffective use of roads.

Urban logistics provides people the third solution – public transportation. Creating effective and well organized system of public transportation is the main task of the city authorities. This kind of travelling enables the improvement of ecological conditions in the city, reduces traffic congestion[5] and minimizes degradation of roads. Moreover, public transport should be also opened to various requirements its users.

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zarządzania przepływami osób i ładunków w miastach, Akademia Ekonomiczna in Katowice, Katowice, p. 105).

[5]Mutual difficulty of movement by vehicles regarding to existence the objective dependence between speed of the vehicles and the size of flows in conditions, when the degree of use the transport system capacity comes up to exhaustion (J.M. Dargay, P.B. Goodwin: *Traffic Congestion in Europe. Introductory Report England. W: Traffic Congestion in Europe*. OECD 1999, p. 160)

The term “sustainable transportation” stems from the concept of “sustainable development”. The term, which was first coined in the United Nations World Commission on Environment and Development 1987 Bruntland report called "Our Common Future", puts forth the idea of development that meets the needs of the people today without compromising the ability of future generations to meet their own needs. Sustainable development is the idea of deliberate decision making in order to direct global development and system evolution towards a more sustainable route. The critical importance of public transportation as a strategy in sustainable transportation was highlighted by a study called "Millennium Cities Database for Sustainable Mobility" conducted by Vivier (2001)[6]. The group, based in the Institute for Sustainability and Technology Policy (ISTP), University of Murdoch, compiled data on demographics, economics and urban structure, vehicle population, taxis, road networks, parking, public transport networks (supply, use and cost), mobility of individuals, the choice of transport mode and transport system efficiency and its environmental impacts (travel times and costs, energy use, pollution, accidents, etc.); these data were analyzed and 66 raw indicators were developed. The sample for the study included 100 cities from developed and developing countries in Western Europe, Eastern Europe, North America, Latin America, Africa, Middle East, Asia, and Oceania. According to the study, private automobile dependency is increasing in a majority of cities in both developed and developing countries. It is expected that by 2020, demand for urban mobility would have increased by 50%. The study predicts that if nothing is done to curb the use of automobiles, it will absorb all of the biggest part of urban travel demand as well as generate all the congestion and pollution it brings about. The burden of the automobile on the economy, resource use and environment in comparison to public transport was calculated as well (Table 1).

[6] Vivier, J (2001) Millenium Cities Database for Sustainable Mobility - Analyses and Recommendations. International Union of Public Transportation (UITP) and Institute for Sustainability and Technology Policy (ISTP) of Murdoch University, Perth, Australia.

Table 1. Millenium Cities Database for Sustainable Mobility - Analyses and Recommendations. Source: Vivier. J (2001), UITP, ISTP

Region	Density (persons/ hectare)	Proportion of journey by foot, bicycle and public transport	Journey Cost (as % of GDP)	Annual Energy Use (megajoules /person)	Emissions (CO, SO_z, NOx, COV per person (kg)
USA and Canada	18.5	14%	12.5%	51,500	237
Oceania	15	21%	13.4%	30,500	189
Western Europe	71	*50%*	8.3%	16,500	88
Central and Eastern Europe	55	72%	14.8%	8,000	89
Asia (affluent cities)	134	62%	5.4%	11,000	31
Asia (other cities)	190	68%	13.6%	6,000	84
Middle East	77	27%	9.2%	15,500	215
Africa	102	67%	21.7%	6,500	148
Latin America	90	64%	14.3%	11,500	118

There are two main reasons why public transportation is focused upon in the idea of sustainable transportation. First is the theoretical justification that public transportation contributes to sustainability and second is the empirical data that suggests that improving public transportation system efficiency and effectiveness is critical to solve the mobility problems faced by many cities around the world.

2. Alternatives for multimodality

People relocation in the city causes many problems for travelers, other people who live in the city and for the natural environment. It also creates traffic jams, lengthens travels` time and increase the emission of exhaust and noise, which disturb comfort of stay in the city. All these problems can have a big influence on inhabitants` satisfaction (on Quality of Living –QoL).

Urban logistics aspire to integration of relocation system in cities, which can improve travelling process, shortened its time, reduce its individual and social costs regarding traffic congestion, protect natural environment or increase inhabitants` perception do QoL[7].The integration of relocation system belongs to the basic area of logistics` interests. Because of that urban logistics pays more attention to multimodal transport regarding people relocation in cities.

Multimodal transportation is an inner integrated transport by using at least two types of transport modes in urban travels. It is also called "combined" public and individual transportation. Particular modes of transport in multimodal transportation are no longer autonomous, because they become successive ways of relocation, which are coordinated for example by the city. The main reason of applying multimodal transport is reducing traffic congestion. Below it is presented the example of multimodal transportation regarding people relocation in the city.

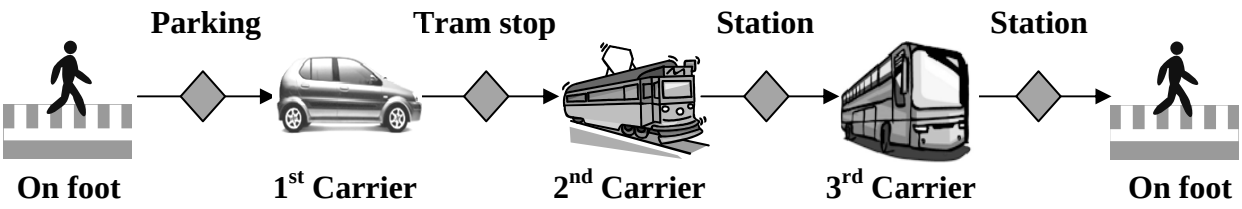

Figure 1. Multimodal urban travel. Source: Own elaboration

Multimodal transportation is a suggested solution, which is used in cities, where the urban area was divided on four transportation zones[8]:

- zone 0 – where people travel only on foot,
- zone A – there is the biggest concentration of travelling purposes and also limited surfaces of roads and parking areas. This zone should be served by well organized public transport with limited individual transport (cars),
- zone B – there is a medium concentration of travelling purposes. In this zone there is an ability of co-operation individual transport and good quality public transport,

[7] J. Szołtysek (2007), *Podstawy logistyki miejskiej*, Wydawnictwo Akademii Ekonomicznej in Katowice, Katowice, p.78.
[8] Tamże, p. 68.

- zone C – there is a small concentration of travelling purposes. People in this zone mainly use individual transport.

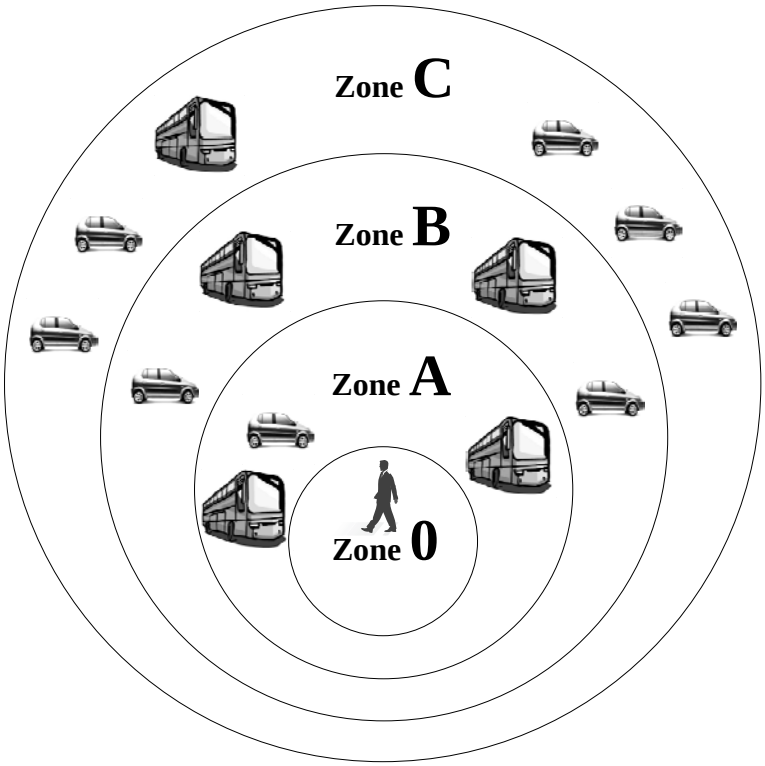

Figure 2. Division of the city into zones. Source:: J. Szołtysek (2007).

We can say that the nearest zone zero the biggest use of public transport. Individual transportation is exploited mainly in zone C. Division into the zones facilitates forming the structure of urban transport. This concept also limits abilities of using irrational carriers in zones which are the nearest the city center.

The concept of multimodal transport regarding people relocation created some model solutions, which can be used in cities all over the world. We would like to present three of them: Park & Ride, Kiss & Ride and Bike & Ride.

The Park & Ride is the solution, which encourages cities` users to limit traveling by cars in the cities. There are special car parks with connections to public transport that allow commuters and others wishing to travel into city centers to leave their personal vehicles in a car park and transfer to a bus, rail system or carpool[9] for the rest of their trip.

[9]A privileged vehicles` movement, where people share a ride with other people who live or work near each other. This is an alternative of driving alone. Carpooling relieves stress, saves time, cuts parking costs, reduces air pollution, diminishes traffic jams and saves money. Carpooling also makes sense for trips to the grocery stores, shopping malls, or to another cities (http://www.london.ca/d.aspx?s=/Carpooling/default.htm - 01-05-2009).

The vehicle is stored in the car park during the day and retrieved, when the commuter returns. Park and rides are generally located in the suburbs of metropolitan areas or on the outer edges of large cities. Park and ride schemes are often marketed as a way to avoid the difficulties and cost of parking within the city centre. Park and ride facilities allow commuters to avoid the stress of driving a congested part of their journey and facing scarce, expensive city centre parking. They are meant for people who do not have ideal public transport from their home either because of where they live, the time it would take, or the hours they work. Some commuters have a free parking place provided by their employer, and those usually prefer to drive all the way to work. In many cities stop in the city centers will be forbidden, that is why parking areas will be inside the buildings.

Assurance of individual and public transport proper condition of function must be consistent with car park politics and adopted to communicative situation in cities. Till 2015 affirmation of car parks will be one of the main tasks current cities[10].

Most facilities provide services such as passenger waiting areas and toilets. Travel information, such as leaflets and posters, may be also provided. Moreover, at larger facilities, extra services such as a travel office, car wash, bike rental, cafeteria and a staffed laundry may be provided as well. These are often encouraged by municipal operators to improve the attraction of using park and ride.

The Park & Ride system was successfully implemented in many countries.

One of them is Edinburgh, where The City Council and partners, Lothian Region Buses (UK bus operator of the year 2007), “TIE” a private Ltd project management company set about implementing the construction of a number of Park and Ride facilities in that region. In early 2008, Edinburgh has four successful Park and Ride facilities in operation Hermiston, Ingliston, Ferrytoll and a rail link at the Newcraighall site. There was also created a new website which provides commuters all the information they need, with up-to-the-minute info on bus and train services, route maps, details on each site's capacity and the facilities available.

Positive public opinion and high patronage figures are the best way to gauge the success of any public transport initiative and both sites are currently operating at 80% capacity and 500 new spaces are to be created at the Ingliston as early as the summer of 2008. About 92% of drivers thought parking conditions were good and also about 85% were impressed with the

[10] M. Boltze (2003), *Intelligent Parken In der Stadt der Zukunft.* ” Internationales Verkehrswesen”, No 6, p. 290 – 291.

service. Moreover, about 90% thought it was good value for money and 84% said the security was excellent or good.

Sarah Boyack who is the Minister for Transport and the Environment said: “Scotland has a diversity of park and ride schemes, the most successful schemes offering a fast, frequent and less expensive way to access an urban area than the equivalent car journey”[11]. Mr Swinney the Cabinet Secretary for Finance and Sustainable Growth said: "Reduced congestion, fewer cars on our roads and a less polluted environment. This facility and others like it being built right across the country are delivering real benefits for Scotland[12].

Another city, where Park & Ride solution was successfully adopted is Canterbury in South East England. Known as the greenest, cheapest and fastest way of travelling for those who want to get to Canterbury city centre. The vehicles are low-floored with no entrance steps, making them fully accessible to pushchairs and those using wheelchairs. There are three Park and Ride sites, at Wincheap, New Dover Road and Sturry Road. Commuters who regularly use Park & Ride system also get a great discount by purchasing a Park & Ride Card what gives all day parking for only £2.00. They also spend less time in traffic and queuing for car parks, the vehicles use bus lanes and often have priority at traffic lights Buses run throughout the day and early evening, much of the centre of Canterbury is pedestrianised, making it a safer, cleaner and more pleasing place to wander around[13].

Park & Ride is a high quality bus service that provides a convenient and stress-free alternative to peak time congestion and expensive town centre parking in United Kingdom.

The Kiss & Ride is a designated area (identified by signs) for parents picking up or unloading their children by private vehicle. The area is separate from the bus loading or unloading location so there is no conflict with the two operations. For the Kiss & Ride to function properly, several procedures must be followed[14]:

- a school staff member, normally assisted by student safety patrols, provides supervision,
- children load and unload from the passenger side of the car only, so they will not have to cross the driveway in front of traffic,

[11] http:// www.scotland.gov.uk/News/Releases/1999/12/0d9f6769-0690-4803-9951-b7a06028861b (03-05-2009)
[12] http:// www.spt.co.uk/News/090303_swinney.aspx (03-05-2009).
[13] http://www.kent.gov.uk/transport-and-streets/public-transport/planning-your-journey/park-and-ride.htm (03-05-2009).
[14] http://www.fcps.edu/fts/safety-security/publications/saf-4.pdf (02-05-2009).

- drivers remain in the car and safety patrols will assist with the car door,
- cars stay in a single file line as they move to and from the Kiss & Ride,
- parents who want to enter the school must park in an available parking space. They are not allowed to enter the Kiss & Ride line in this case,
- parents with their children should arrive early. The busiest time at the Kiss & Ride area is five minutes before the start of classes. Plan to arrive 10 to 15 minutes before the final bell, when the traffic is lighter.

Kiss & Ride was successfully adopted for example in Middlesex in United Kingdom. In November 6, 2008 Thunder Bay's Community Traffic Awareness Committee (CTAC) was celebrating the launch of the Kiss & Ride program at St. Martin School in Middlesex. This program involved a structured system for handling the influx of students being transported during peak times, while reducing vehicular congestion in front of the school. St. Martin is the second school in the City to offer a specialized area designated for a Kiss & Ride program. CTAC originally began a pilot project with St. Bernard school in 2005, where the program has been running effectively.

St. Martin School Principal, Barb Van Hatten said: "This program satisfies the safety concerns of most parents, because it allows children to be delivered to school by caregivers and ensures children get safely into the school under the supervision of school staff,"[15] This solution is very profitable also for parents, teachers and police because assuring safe approach to school is one of their main tasks.

This solution was also adopted in Canada in many schools. Parents drop off their children in the designated Kiss & Ride area every morning. Then a safety patrol officer operates the gate at the entrance to the school and allows 4 vehicles in at once. Parents must leave the engine running and ensure that their children safely exit on the curb-side of the car. Safety patrols assist with car doors and ensure them gets safely inside the school. In the afternoon, when it is more congested with traffic, parents pick up their children in the designated Kiss & Ride area. A safety patrol officer operates the gate at the entrance to the school and allows 4 vehicles in at once. Parents must put their sun visor tag on the passenger site in visible place because patrol officer must identify their cars at first and then have their children ready for pick up zones at each individual school. While parents remain in their cars, volunteers safely escort children to a designated area. This system is a win solution for everyone involved.

[15] http://www.tbdhu.com/Resources/News/2008/November/StMartinKissandRide.htm (03-05-2009)

A Kiss & Ride facility may be implemented at various schools all over the world; however, its success is depended on the commitment of the school and volunteers.

The third modal solution is Bike & Ride. This conception tells about travelling on the bicycles, which people can later take to public transport. Some of the cities offer special kind of buses` equipment. Each bike rack can hold two bikes and each bike can be loaded or unloaded without affecting each other. Bikes are held firmly in place by spring-loaded clamps. Bikes do not touch each other or the bus, assuring safe, secure transport.

For the Bike & Ride to function properly, several procedures must be followed[16]:

- bicycle wheel size must be 20 inches (51 cm) or larger,
- all loose items (e.g. water bottles, bags, bike pumps, helmets) must be taken off the bicycle before placing it on the rack,
- bicycle flags, baby seats and baskets are not allowed as they could restrict the drivers' visibility,
- bicycles are not to be locked on racks,
- racks are on a first come first served basis with a maximum of 2 bicycles per bus. No queue jumping please,
- for safety reasons the bus driver is not required to assist with the use of the bike rack and should remain seated in the cabin while the passenger is loading or unloading their bicycles.

Bike & Ride solution was adopted for example in Leipzig in Germany. People have a possibility to park one's bike safe and under a weatherproof shelter right next to the public transport stop. Therefore many parking areas for bikes at important bicycle and public transport interchanges have been built. The Bike & Ride stations exist at all terminal stops of the tram, at important S-Bahn (urban railway) stations and other important bus and tram stops. The bike parking facilities are individually adapted according to the local conditions and requirements. Up to now 28 Bike & Ride stations have been erected with a capacity of up to 1,000 bikes. About 20 of them are situated at the periphery; the others adjoin the city centre.

Michael Replogle, Environmental Defense transportation director said: "There's no doubt that bicycling is not only great for your health but saves money on fuel and reduces greenhouse gas emissions. It offers a way to get more people on mass transit at lower cost. Given the low cost of building and maintaining bike stations, we can both afford and physically accommodate a lot more bike spaces than we can car spaces. And it can free up

[16] http://www.action.act.gov.au/bike_n_ride.html (02-05-2009).

now crowded park-and-ride spaces that often fill up early in the morning, so people who can't bike can more dependably catch a ride on transit. There's great untapped potential for bike-and-ride commuting across the country." He also said: "Bike-and-ride is going to be most effective first in places where there is a fairly higher concentration of jobs and houses within a radius of a half-mile to one mile from public transportation stops, and where there are safe and attractive conditions for bicycling."[17]

3. Summary

Well organized, effective and integrated relocation system is the best solution for cities which want to assure the highest standard of life and also contribute to environment's protection. Coordinating flows of people should be maximally based on employing multimodal system in cities. Multimodal transportation use all over the world above all improves travelling process and minimizes traffic congestion. Elimination of cars allows for increasing quality levels of living standards in a city – not only by means of some decrease in congestion but also through less exhaust and noise. Additionally, elimination of car related traffic in cities provides new areas to be alternatively used (i.e. more green spaces, creating new bicycles routs). Public transportation is the most profitable way of travelling. Mainly use in multimodal transportation is focused upon the idea of sustainable transportation. At present the integration of people movements is desirable in many cities. Some of this solutions like Park & Ride, Kiss & Ride and Bike & Ride assure the improvement of urban life style and bring long enchanted effects.

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Basement for modeling of the common information area of a transport and logistical complex

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Abstract
The Common Information area covers all elements of transport and logistical process and assumes carrying out of an innovation in all key activities of a transport and logistic complex of the Northwest of Russia taking into account consolidating of information streams and strengthening of a role of responsibility. The model of the Common Information area is characterized by activity involving of the user in process of development and perfection for achievement of understanding of the user requirements and appropriate allocating of functions between users and technologies. At its introduction interaction between all participants of transportation process essentially changes, and transportation process becomes transparent at all stages.

Keywords: ACS, E-logistics, Common Information area**,** railway IT systems, integrated IT-solutions.

1. Introduction

Today's IT solutions for operation fail to fully support the integrated processes of planning, producing and delivering services. The result is insufficient clarity at all segments of the value chain concerning the allocation of the resources needed to provide the services. This makes it hard for managers and planners to recognize and take advantage of opportunities for optimization. It also keeps them from reacting to markets changes in due time, or even at all.

The railway market demands a new IT solution for integrated support of critical business processes from simulation and planning through to operational processes for all required resources regarding vehicles and personnel.

Typical problem moments are:

- Financial and managerial monitoring on basis of incomplete information (did we really do what we have planned?);
- Labor-intensive efforts for planning, operation and accounting;
- Lack of timely. detailed and reliable information;
- A planning approach that separates vehicle turnaround from staff and from vehicle maintenance;
- Insufficient or late communication between involved personnel and services;
- Inability to respond to frequent challenges and to simulate future scenarios;

- Rapidly changing business processes.

The design of a modern IT-solution for planning and operation is based on:

- An integrated approach for planning and operation management;
- The ability to rapidly develop operational scenarios and to simulate models;
- The integration into existing IT environment;
- Step-by-Step implementation of modules and their immediate entry into service;
- Ease of use;
- System that can be adapted to internal and external changes and requirements;
- Software experts with deep understanding for and experience in the railway market

Today's Russian logistics operators are confronted with partial solutions limited to single tasks. Modern, integrated IT solutions, which support the complete planning and operation process of all involved resources is what they are looking for. They need a package that embodies the whole service provisioning process without costly interfaces that can limit functionality. Just as important is the required ability to introduce new processes within the system.

Introduction of the Common Information Area of a transport and logistical complex in the northwest of Russia offers advantages to realization of various commitments. In this case interaction between all participants of transportation process essentially changes. Transportation process becomes transparent at all stages. It creates essential benefits for each participant. At the analysis of the information received by users, there is a possibility to show those directions which are necessary for developing, for better accomplishing of process of transportation.

The model of the Common Information Area will allow creating a principle of information interaction for any new participant of the logistic market.

Figure 1. Ways of concentration of common information area model

Model use is possible in following directions:

1. A basis for creation of principles of information interaction;
2. A basis of creation of new software products;
3. A basis for creation of standards (reports and elements) an information exchange of ALL participants of the logistic market;
4. A scientific justification of political will for deducing of information interaction on the transport and logistic market and creations of the competitive environment in region transport.

On 29th of April, 2009 in JSC RZD Scientific seminar was held. The main theme of it was “Need of improving effectiveness railway container transportation in Russia, and also in transit traffic”. Main question of the seminar was innovative product “Transsib for 7 days” and main priorities were announced. Main priority in changing of transportation technology was development of modern IT-technologies by implementing of electronic document interchange with international standards of interaction and electronic signature for all key documents and messages. Vladimir Yakunin mentioned that in the world there are interesting technologies of interaction for example in companies Happag-Lloyd and port of Hamburg.

2. Proposal for Russian transport-logistics complex

At present in Europe projects on management of information resources intermodal transportations, not having analogues in the Russian practice are realized. The European experience of introduction of information systems and the information field organization is most brightly presented with system DAKOSY of port of Hamburg (www.dacosy-direct.de). System covers more than 150 freight forwarders and 500 transport companies. Now DAKOSY was beyond Hamburg and concerns logistic chains between Hamburg and its surrounding territories. The system is based on the central database which allows to store and process the information.

The basic fields of interest of the system:

- The Center of an information network. DAKOSY offers all transport companies interfaces EDI and systems EDP. DAKOSY is designed as open system.
- Idea Realization "the Paperless port" includes standard and paperless handling of full cargo transporters in the port Hamburg.

- System ZAPP (Electronic Customs Export Monitoring in the Paperless Port) has been designed to allow all participants of export process — to exporters, freight forwarders, linear agents, the navigable companies and berthing operators — to have a beam coupling with the Hamburg Customs through system DAKOSY.

Figure 2. DACOSY system startup menu.

Realization of the system similar to systems DACOSY or Hapag-LLOYD (www.hapag-lloyd.com), in Northwest Region Russian Federation will allow improving directions of the work for following participants of process of delivery of cargoes.

3. Realization

Let's have a look to the operation, which will be solved by means of the Common Information Area. The consignor legalizes papers on transportation.

The logistician of the shipper makes up the demand by input in system key parameters of transportation. On the basis of the put algorithm the system, makes up variants of a route of cargo on a basis: a choice of a type of transport, a place of an overload, and other set parameters. On each of variants approximate time and transportation cost pays off. The operator himself builds a chain of following of cargo, determines participants of process of transportation and builds the transportation plan, being guided by indicators, which are effective for concrete sending. The system makes up information packs for each participant of transportation process and brings there that information which is necessary for work. This information is transferred in sis-themes of carriers. At the moment of the transportation beginning in system the information on a dispatching cargo is transferred.

Further the logistician watches cargo advancement, at each stage can supervise timeliness of maintenance of cargo transport and cargo transfers on a warehouse of a temporary storage or cargo transfer to consumer.

All process of transportation is supervised within the limits of one information system. All information systems exchange the operative information only in a mode of real time (by direct inquiry of the logistician). All interested parties (the consignor, the consignee, the freight forwarder, and management of the carrier) can always see, where and at what stage there is a cargo or as transportation process in an access mode to “single window” proceeds.

4. Planning in Common Information Area

a. The Common Information Area provides all planned and actual activities of objects and personnel and monitors all productive and non-productive activities. It also provides key management indicators and a reliable basis for investments, new business scenarios and personnel requirements. The system enables planners to quickly adapt their plans to new information as the operations period approaches. Management gets the results to compare planned and actual data right after operations period and can react to deviations quickly. With all relevant data in a single system the ongoing adjustments to changes are much simplified. Information for all relevant parties is available. The result is an increase in the quality of work

based on up-to-date and correct information, and a significant reduction in the workload of operation supervisors (“Manage, don’t telephone”). (Dirk Pfeiffer – “RailOpt2”)

b. The Operations Management or dispatching module supervises operations and helps finding solutions in case of emerging problems such as late trains, line blockages and the sudden unavailability of particular employees or vehicles**.** The Common Information Area offers numerous functions that allow the operations supervisor to react quickly to an incident. Quick queries and shortcut buttons allow the user to fully and reliably master a conflict situation. The key advantage of the simultaneous overview of all involved resources becomes here obvious: System immediately displays the consequences of an incident and enables their solution in accordance with the pre recorded rules. In this way, when replacing one vehicle by another. The operations supervisors can be sure that the time situation allows use of a specific vehicle. To relieve the operations supervisor from extraneous tasks, especially those related to communication with drivers in the field, the additional module for Driven Information System (DIR) is of particular importance: This module transmits timetable changes directly to a mobile device such as a GSM mobile phone. The device displays, for example order number and location for the driver without any intervention by the operations supervisor.

5. Problems

Creation of the Common Information Area generates a number of the problems which decision will be favorable to all participants’ intermodal transportations:

- Market condition studying, forecasting of demand for new information system, determining of the optimum commitments, which accomplishing will be effective;
- Creation of new ways of reconstituting of the information and improvement of process of transportation on the basis of optimum control of information streams;
- Search of rational forms of interaction of the transport companies, Common Information Area sand governing bodies of St.-Petersburg and subjects of the Russian Federation of Northwest region;
- Construction of various variants of models of functioning of the Common Information Area for satisfaction of demand of various target audiences;
- Improvement of quality of the information product, allowing maintaining a competition on a foreign market;

- Consideration of possibility of application of outsourcing, for decrease in expenses at development cycles and functioning maintenance.
- Expert estimation and testing of the user interfaces of all software of railway transportation.

It is possible to consider as prospect of developing of the given model creation of regional knots and their consolidating in uniform system on the basis of Internet technologies. The given system will help to trace the basic transport corridors and to inform operation personnel and the customer on problems in the course of deliveries of cargoes to the receiver.

6. IT solutions for realization of Common Information Area

Platforms and decisions are necessary to model, and in realization of user interfaces. For qualitative development of model it is necessary to consider a number of the specific moments inherent in an information technology:

1. Objects of an information exchange and its rule;
2. Ideology and architecture of integration program interaction (an integration infra structure);
3. Criteria for creation of the unified intellectual interfaces.

The integration infrastructure is the binding environment between diverse appendices. A system kernel is allocation of commitments of the integration independent of specificity of concrete MANAGEMENT information systems and their decision.

For integration of the systems using different formats of reports and reports, 2 variants of realization of the integration decision are possible:

Systems are integrated everyone to everyone, each communication between separate knots is performed irrespective of others.

Interaction of each system with the kernel of integration providing an information transfer from one knot to another.

Integration of appendices and MANAGEMENT information system has as well various characteristics, in particular, necessity of concentration of efforts on a commitment of information interchange for integration.

As integration infrastructure on the basis of a kernel of system of integration the wide circulation was received by media of exchange the information message oriented middleware (MOM).

For existing classical information systems of railroad communications and systems the interface of interaction of systems should satisfy to following technical requirements:

1. Interaction should be performed under report HTTP of family of reports TCP/IP. Thus for maintenance of confidentiality of the transferred data between systems it is necessary to use the protected connection under report SSH.
2. Interaction of systems should be realized as a kit of the "Web-services" given by systems for accomplishing of necessary functions, namely: data acquisition NSI, reception of a specification. For the organization of the popular services used not only for interaction ECASUTR (SAP HR) and IOMM (Integration processing of Driver Route Document), it is necessary to use report SOAP (Simple Object Access Protocol – the Simple Objective Report of Access). For unique commitments of data exchange it is enough to cause HTTP inquiry and to obtain the data in for mat XML.
3. Each interaction between systems is one complete transaction and in case of failure on any of domestic steps should be cancelled entirely. Successful end of a session of an exchange should be fixed in control magazine.
4. Interaction of systems should be carried out asynchronously under the claimed regulations.
5. It is necessary to develop the browser of control magazine for monitoring of processes of data exchange by system SAP means.
6. To Develop from each of the interfaced parties the document describing services and parameters of start, in format WSDL (Language of Description Web of Services) in case of application SOAP, or a format returned document XML and rules of making up URL.

7. Interface

The model of the Common Information Area is characterized by active involving of the user in process of development and perfection for achievement of understanding of the user requirements and appropriate allocating of functions between users and technologies.

Application of this model in software development on transport represents especial interest. MANAGEMENT information systems on railway transportation everywhere find

extensive application. The labor productivity increase for the account of "the razed reserves» user interface of the MANAGEMENT information system bears essential benefit.

The user interface, being system of rules and the means regulating and providing interaction of the program with the user, plays the important role. This year, with support of experts of St. Petersburg Information and Data Center, JSC RZD some aspects of the user interfaces of such systems as «ETRAN», «Logistic System» and «Cargo Express» have been analyzed.

Determining of basic possibility of improvement of the user interface of the given systems has been based on the analysis of quantity of the information given to the user and elements of the existing interface.

After the analysis of possibilities variants have been developed for improvement of interfaces – detailed prototypes of "improvement". By means of model of speed of the press the most successful has been specified. For an estimation of this variant, from all volume of functions of systems, have been designated most often used by the user for the decision of the primary goals. So, one of considered user commitments for system "ETRAN" had been chose a commitment on waybill filling.

Each user action broke into elementary operations and their estimation was manufactured. Delivery capacity of the user interface for the set function with application of detailed "improvement" has increased more than on 30 %.

Similar results have been received by consideration of the user interfaces of system «Cargo Express». Thus, it has been received substantiation possibilities of improvement of already existing systems and their user interfaces with economy of working hours on the average more than 32 % on the basis of model of interfaces of the Common Information Area.

8. Estimation of functioning and problem of introduction of a common information area of logistic systems

Basis, for an estimation of functioning of any information system, the mutual relation of expenses for system introduction to a positive effect realized by an innovation (improvement of quality of service, decrease in costs, and increase in delivery capacity or reception of additional financial benefit) is. Therefore, the Common Information Area assumes carrying out of an innovation of all key kinds of activity of a transport and logistic complex of the

Northwest Russian Federation taking into account consolidating of information streams and strengthening of a role of responsibility.

Efficiency from introduction of the Common Information Area will consist of following improvements:

- Acceleration of process of a handling of documents on customs points.
- Decrease in period of validity of the demand/plan for transportation/loading.
- Decrease in time of a handling of documents in a place of arrival of cargo.
- Improvements of already existing MANAGEMENT information systems and their user interfaces.

9. Conclusions

Now in Russia certain steps on introduction of technologies which are considered as the tool of the organization and information support of all chain of participants on creation, manufacturing and production realization at all stages of life cycle are undertaken. These are systems of the coordination of approaches of rail cars and trains with cargoes to ports, to border stations, systems of electronic exchange between consignors and JSC "Russian Railways", and systems of the preliminary notification about the approach of cargoes to customs points. But effective application of such toolkit probably only on the basis of system of the integrated logistics which is "kernel" of the given project. Application of various variants of reception of access to the Information field will help to create «single point to access» in which it will be possible to receive any information on a course of process of delivery of cargoes to consumers.

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Development of a transport infrastructure of northwestern federal district

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Abstract
Northwestern Federal District of Russia is a transport bridge between Russia and the West, links the world markets of Central and East Europe, countries of the CIS. A transport system of region provides both internal and international connections. Taking into account development of international trade and growth of volumes of transportations loading on an existent transport network will be increased. It will demand the proper development of all transport complex of Northwest.

Keywords: Transport, development, infrastructure, traffic

1. Geographical potential of the Northwestern Federal District

Northwestern Federal District comprises the Republic of Karelia and Komi. Large areas, including: Leningrad, Kaliningrad, Novgorod and Murmansk, and others, as well as St. Petersburg. The production and technical potential of the region allows attributing it to the industrialized regions of the country. Here is concentrated the major production of phosphate raw materials, pulp, paper, timber and mineral fertilizers. The development of economy of the district relies on a high level of industrial development, the use of its natural resources, and geographical location.

The presence of the largest ports of the Baltic Sea and the second cargo seaport in Russia, leading in the country for processing dry cargo and container, a developed network of roads and railways, air traffic system, Volga-Baltic Waterway, pipeline makes St. Petersburg a major transportation center of the country.

Developed transport infrastructure of Northwest region enables it to occupy a leading position in the country, in terms of export and import capabilities. There are 13 ports, 14 border stations. Northwest region served by the October, North and Kaliningrad Railways.
Now, estimates of the Ministry of Transport and Communications of Finland, freight traffic in Russia is growing at 7% per year, about 40% of European exports are in transit through Russian to Finland. Immigration Station processed approximately 15 million tons of cargo trade. In connection with the increase in traffic, the major challenge congestion of trucks at the border.

In the year the volume of international traffic in St. Petersburg, through the railway border crossings called Svetogorsk, Värtsilä, Kivijärvi, Ivangorod, Skangali, Posin and Pechory-Pskovskie is more than 50 million tons, with exports far exceed imports. Import is 90% in relation to the import (export) of 10%. The main cargo going for export, now are mineral oil, wood cargoes, metals, coal and fertilizers.

2. Problems of a transport policy and way of decision

The planned volume of freight by rail in communication with the transfer points along the border with Finland by the year 2015 will be: in the direction of export 25 million tones, import, 2.4 million tones.

There arises the problem of the need to optimize transportation and logistics sphere in border areas through the construction of new facilities.

The next step for the elimination of congestion at the border suggested that the Government of Finland. It is considering the possibility of reorienting the flow of goods coming from Europe to Russia, from road to rail. Railway workers have already begun work on the development of Russian-Finnish transport. Thus, the Russian; Trans Container with

Finnish Railways has started a container train from the port of Hamina to Shushary in St. Petersburg. However, infrastructure does not keep up with the rising volume of traffic. A St. Petersburg sea port, even after the implementation of all projects and upgrades will be able to handle only a minuscule portion of traffic coming from the Baltic States. The planned establishment of marine passenger terminal in St. Petersburg will add additional pressure to the main channel.

The State and the interested companies are paying close attention to the port of Ust-Luga. The port is building terminals of different specifications, primarily focused on transshipment of coal, general (including container terminals), bulk and liquid cargoes. The total volume of traffic with the rail in communication with the port of Ust-Luga in 2010 is projected at 16.4 million tons in 2015, 21.5 million tons.

Accelerating growth and modernization of Russia's economy, the processes of globalization on the world market share of RZD to advance the development of facilities for the export, import and transit of goods,

3. Major investment projects of JSC «RZD» in Northwest region of Russia

Over 1.5 thousand kilometers of new railways will be built in the Northwest region of Russia to 2030.

One of the biggest investment projects of the October railroad - the development of railway approaches to the port of Ust-Luga. It includes the development of the Mga - Gatchina - Veynmari and construction of the station Luzhsky.

The main problem is the development of border checkpoints. For example, realization of one of the largest projects DWS - The organization of high-speed traffic on the line Saint Petersburg - art. Buslovskaya with leaching of freight traffic on the parallel branch. Attribution Buslovskaya status of an international station, which is necessary to bring its equipment in accordance with the requirements of customs and boundary services

The third important for the Northwest transport complex project - the development of railway approaches to the ports of Primorsk and Vysotsk, its implementation would increase the capacity of the Popovo - Vyborg from 15 to 22 pairs of freight trains in days

Another investment project - the development of the Murmansk hub and strengthening the North course DWS Volhovstroy - Murmansk - also aimed at increasing the capacity of transport infrastructure of Northwest region

4. The basic objects of developing of a transport infrastructure

Construction and reconstruction of infrastructure of Big Port

Developing of admission rate of the Big port of St.-Petersburg for the purpose of reorientation of the Russian foreign trade cargoes to the Russian ports; a shipping goods intensification; tourism developing.

The implementation of the project will:

- increase the port facilities for transshipment of containerized cargo;
- raise admission rate of sea channels, railway and road approaches;
- increase the volume of rail transportation of containerized cargo;
- reduce the residence time of cargo at the port until 1-3 days;
- Enter work “24 hours a day / 7 days a week/365 days of the year” for all organizations to ensure the port and import / export of goods from its territory;

- introduce modern technology and technical means of inspection of container cargoes;
- Establishment of surrounding terminals for handling container cargo (“dry ports”).

Characterization of project

Big port - next to the central part of the country, the seaport, through which runs the shortest sea route from Russia to Europe, providing export and import to the Russian Federation.

Through the Big port of St. Petersburg in Russia supplies 50% of all imports and exports 11% of total exports of goods transported by sea.

The project includes:

- Reconstruction of the St.-Petersburg sea channel;
- Construction and reconstruction of infrastructure I-IV areas of Greater Port of St. Petersburg, the new areas in the town of Lomonosov, pos. Bronka, and Kronstadt;
- Construction of sea passenger terminal on Vasilevsky Island.

Construction of Expressway in the Latitudinal Range

Optimization of a clearing stores by motor transport from the Big port of St.-Petersburg, improvement of the intercity motor transportation report. Characterization Project

The project involves the construction of highway with 6-way carriageway, and traffic interchange with WHSD (in the fertile st.), With Vitebsky Ave, overpasses over the rail lines of the Moscow, junctions with Obukhovskoy of Defense, the Far Eastern Ave and the bridge over the River Neva.

Construction of a second vehicle bypass of St. Petersburg

The organization of automobile bypass of St.-Petersburg for transit motor transport in the conditions of increase in volumes of foreign trade of the Russian Federation.

The implementation of the project will:

- increase the flow of transit vehicles;
- raise admission rate of automobile lines of a city and area;
- decongest the city roads and highways.

Characterization Project

Construction of high-speed highway category 1-B with the carriageway at 6 and 8.

1st queue length of 60 km: the section from the highway M-20 Saint-Petersburg - Pskov - Pustoshka - Nevel to the border with the Republic of Belarus to the road «Cola» with the construction of a bridge over the River Neva.

Construction of bypass St. Petersburg railway junction

Output from the Saint Petersburg transit, following in the direction of Finland and the Russian ports located on the northern coast of the Gulf of Finland.

The implementation of the project will:

- Increase of cargo transportation in the region;
- Provide transportation and environmental safety in the city.

Characterization of project

Construction of new railway line in two directions at the Myaglovo - Kapitolovo, strengthening of the Mountains - Myaglovo with the construction of 2-second rail bridge over the River Neva in the area of Pavlovo-on-Neve.

Investments for the development of rail infrastructure, especially related to the port, can give effect only under conditions of adequate development of the railway and port infrastructure, optimization of the interaction between the port and railway, which is based on common manufacturing processes joining stations and approaches to them.

The main activities to improve the quality of railway transport

- Ensuring the adequate development of the railway and port infrastructure
- Optimize the interaction between the port and railway, based on common manufacturing processes of the ports and stations joining adapted to new economic conditions
- Continued work on a treaty on the financial responsibility for late ports unloading wagons, and railway-for late filing under the unloading of cars;
- Develop and implement, together with large companies - owners of cars, shippers and consignees efficient technology of the transportation process in the joint operation in the Russian railway wagons belonging to different owners

- Implementation based on marketing and market analysis for individual work with clients
- Continued work on the containerization of cargo, transportation of containers in the accelerated trains. The Introduction of a container carriage.
- Establishment logistics centers in major transportation hubs;
- Improvement of technology of customs and border enforcement

5. Conclusions

To implement these activities, given their complexity, it is necessary to attract the Ministry of Transport of Russia, the customs and border authorities.

Offered actions for developing of a railway infrastructure allow providing scheduled transportation burdens of cargoes through seaports and border stations, normal functioning of the economy of Northwest Federal District.

Investments for the development of transport infrastructure, especially related to the port, can give effect only under conditions of security based on mutual responsibility, adequate development of rail, road and port infrastructure. Optimization of the interaction between all modes of transport, based on common manufacturing processes of the ports, approaches thereto and adjunction stations that provides adaptation to new economic conditions

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Real options in the logistics investments

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Abstract
In this article is used the theory of the real options, and it can be used in logistic investments. Real options capture the value of managerial flexibility to adapt decisions in response to unexpected markets development. The first case-study evaluates light rail as a local passenger traffic solution for a midsized town. Based on the results**,** infrastructure investment in operating network required plays a pivotal role in determining the profitability of light rail public transportation system. Interestingly, environmental issues can't justify light rail investments alone, even if significant changes would appear in operating environment. The second case-study evaluates security of supply of the ports in the shores of Gulf of Finland (GOF). Based on the results Finnish ports, such as Kotka port, are large and have quite modern infrastructure compared to Estonian ports. Finnish ports handle with container cargo and single consignments. However, in Estonia sea ports are quite small and they have very little capacity of warehouses and container handlings. Estonian ports handle mainly Russian oil. For these facts Finnish and Estonian ports have a limited capability to compensate for each others in operations as need arises.

Keywords: Real options, investment appraisal, railways, sea ports, logistics

1. Introduction

Traditional discount cash flow approaches such as the NPV (Net preset Value) cannot properly capture management's flexibility to adapt and revise later decisions in response to unexpected market developments (Trigeorgis 1997). So these approaches are assumed an expected scenario of cash flows and presume management's passive commitment to a certain static operating strategy. Whereas the real option word is characterized by change, uncertainty and competitive interactions (Dixit & Pindyck 1995).As the new information arrives and uncertainty about the markets conditions is resolved, management may have valuable flexibility to alter its initial operating strategy in order to capitalize favorable future opportunities or to react so as to minimize losses (Smit 1997 and Bar-Ilan & Stange 1998). These kinds of managerial operating flexibility modes are like financial options, and it is known as real options or strategic options in real life Myers (1984), Kester (1984) and Trigeorgis & Mason (1987).

Railway and logistics investment are typically long term investments, which need usually enormous investment costs. These kinds of investments have always uncertainty and risk; therefore investment decisions are usually based on subjective prognoses. When uncertainty and risks increases, more alternatives are needed to react for the uncertain future. Financial

woes, pollution and security of supply are typically risks for the uncertainty future in a logistic world.

European Union regards electrified railway traffic as a safe and environmentally friendly transportation mode. One target of EU transport policy is to shift long-distance road journeys and short-distance air journeys onto railways. In local passenger transportation rail is currently used only in larger cities. At the first case-study evaluates light rail as a local passenger traffic solution for a midsized town. The evaluation is based on investment appraisal methodology. In this case energy and environmental cost treated as the real option, because electrified light rail could be substituted with diesel-busses in public transportation. Infrastructure investments in operating network play a pivotal role in determining the profitability of light rail public transportation system.

The second case-study evaluates security of supply of the ports in the shores Gulf of Finland (GOF). The dominant mode of transport in the GOF is sea about 76% of trade, and other means of transport cover only 24 % (Finnports 2009) In addition to their own import and export, the ports of Finnish and Estonian handle a major share of the Russian transit traffic. Finnish ports have mainly concentrated on container import to Russia, and Estonian ports carry a great share of the oil export from Russia. No study on how the very large maritime volumes could be handled, when the operational environment changes radically, is available. Such changes could occur, for example, if a port or several ports or sea routes would be closed down due to an economic crisis or an environmental hazard. In this case-study reservoir of port capacity is real option: could the Finnish ports be reservoirs of the port capacity to the Estonian ports and vice versa could the Estonian ports be reservoir of capacity to the Finnish ports.

This paper is structured as follows: In the following Section 2 reviews the theory of the real options. In the Section 3 are introduced real option alternatives. Two mentioned case examples are represented in Sections 4 and 5. Section 6 provides discussion and conclusions.

2. Real option theory

The traditional calculating methods such as NPV (Net Present Value) are rigid and can't alloy for flexibility to the changes in the operational environment. When uncertainty and risks becomes bigger it is needed more alternatives to react for the uncertainty future.

Myers (1984), Kester (1984) and Trigeorgis & Mason (1987) have solved this problem by the real option method that is based on the financial option theory and pricing of options. Before real option method it is used no calculating intuitive or logic deduction methods to get flexibility for investment decisions. By using real option it is increased incomes or decreased losses.

The real option method can be observed as a strategic supplement to the normative investment theory, because real options amplify reliability to the investment calculations. However, real options can't make the investment profitable, if the decision makers don't use real options on the right way (e.g. in the right time). In the real option method it is emphasized activity and capability of the decision makers; how is followed markets, technology and competitors by them (Trigeorgis 1997).

Flexibility in an investment decisions means a possibility to react to the changes in an operational environment: possibility to wait for further information or wait for a better time to make an investment. These possibilities have a strategic or another value (Dixit & Pindyck 1994; Trigeorgis 1997). These kind of strategic attributes of real investments are called (strategic) real options SNPV.

$$SNPV = NPV + R$$

, where SNPV is investments strategic NPV

NPV is normally calculated NPV for investment

R is investments real option

An investment can be accepted although its NPV is negative ($NPV<0$ if $R>0$ and $SNA>0$). Usually it is very difficult to use real option model, because it is hard to identify all investments motives. For that reason model describes afterwards how the investment project succeeded. Real options are used, because NPV does not allow taking into account the value of the option to react to a changed situation in alternative ways. Real options in investments can be divided to growth, enlargement, timing, adaption and ending options (Trigeorgis 1997)

3. Real option alternatives

When using real options it is require continuous follow-up of the operational environment: new information must be collected and updated. Based on that information decision makers try to reduce uncertainty and make better decisions by using flexibility of investment by holding over, expanding, refusing, reducing or another way changing operating strategy to increase incomes or reduce losses.

Option to defer, "wait and see"

Presumption of better times is a typically option to defer. In this alternative investor can seek more information about markets, rivals and future to get the best timing for the investment. "Wait and see" describes the character of that option. The option to defer can give to the investor better attitude in the markets and more incomes, if the future is expected to be more favorable than the present time. For that reason decision makers must wait until the value of option meet the case. If the future turns out worse than have expected, the investor can avoid losses from the unprofitable plan (Dixit & Pindyck 1995). To defer an unprofitable investment can have a strong value to the investor's economic attitude and to the scope for action in the future.

However, the option to defer is not necessary in every case, if the plan is clearly profitable in the present and the situation in the market is favorable to react quickly. The quick reaction can create strategic preemptive effects: it can receive maximum profit before the rivals act.

Option to defer is used especially in big and long run investments: in a real property, an oil industry, a forest industry and a mining industry. These branches have enormous investment costs at the beginning of the investment, meanwhile incomes comes for a long run.

Option to abandon

Option to abandon is used in capital-intensive branches, when investments are proved to be unprofitable. Option to abandon is usual and it is used in every branch except for conventional plans. (Myers 1996). The motive to cancellation of an agreement is usually based on markets or situation in the company, but it can be also technological. Option to abandon is used when

new launched product is not profitable (Trigeorgis 1993). Option to abandon and its value have researched by Kensinger (1987), Myers & Majd (1990) and Grinyer & Daing (1993).

Time- to build option, staged investment

Time-to-build option is used in capital-intensive branches (e.g. energy and venture capital) and in an uncertainty circumstance in the other branches (Trigeorgis 1993, Maid & Pindyck 1987). Large infrastructure plans like ports, ways and railways are built in smaller phases in a long run. Research and development plans, big mills and factories are made in a same way. Staged investments are usually used to avoid big losses that investment causes if it flops. Staged investments make possible to think or use also other options (option to abandon or option to defer). Staged options and these values have researched by Majd & Pindyck (1987), Triorgis & Mason (1987), Carr (1988), Trigeorgis (1993), Smit (1997) and Bar-Ilan & Stange (1998).

Option to alter operating scale, option to expand, option to shut down and restart

Some real options enable to alter operating scale or adjust the capacity according to the markets (e.g. add on, cut down or break off the production) are called expand or scale options (Trigeorgis 1997). Reasons for these options are usually economical and when markets allow, the capacity of operation can be moved to assuage the changed demand (adaption to the markets). These kind of real options are very remarkable in a strategy way, because these empower company's possibilities to grow up (Trigeorgis & Mason 1987).

Markets regulate economic activity: if the markets will be worse than is expected, the company can act on a low capacity (Trigeorgis 1997). Option to shut down and restart is used if markets react seasonally: the company can be put out of business for several months.

Options to adapt operational scale are used in mines, oil and forest industry, but it is used also in a real property. Brenn & Schwarz (1985) and Ms Donald & Siegel (1985) have researched option to shut down and restart operation. Trigeorgis & Mason (1987), Pindyck (1988) and Kutalaika & Trigeorgis (1994) have reached optimal capacity, staged investment and option to expand.

Option to switch use, input or output

Options to switch raw material in usage are used in an industrial and service production. It can be produced several products to different markets from different raw materials by the same company. Alternatively it can manufacture several products from same raw materials. The aim is minimize cost and maximize incomes (Trigeorgis 1997, Brealey & Myers 1996). Switch options are used in a car and mobile (telephone) industry.

Technological flexibility has enabled the growth of process industry with long subcontracting companies. This has caused global investments to the areas where costs are low or oversupply from workers. China and India are the most typical example of that development, which have strengthen globalization around the world. How are these options used, depends on many facts: markets, exchange rate, inflation, price of raw material, labor cost, taxes and other that kind of costs (Trigeorgis 1997).

Switch options and these value determinations have reached Kensinger (1987), Kulatilaka (1993) and Kulatilaka & Trigeorgis (1994). The usages of switch options have reached Amram & Kulatilaka (1999a & 1999b). Also Dixit & Pindyck have reached value of switch option in flexible technologies.

Growth option

Growth options have strategy expectation value that effect in the future growth and good profitability expectation (Kester 1984). The traditional investment calculation (NPV) is based on static environment and do not take into account investments strategy effects for the future. For that reason it is profitable to realize strategic important investments, although these should be unprofitable in the traditional calculation (NPV) way evaluated. Besides, real options engender normally new options for the future and this contributes to realize long run plans (Dixit & Pindyck 1995). Because executed growth options encourage new options that rely on each others.

4. Case: Real option in a short distance light rail passenger transportation solution in a midsized town

Research environment of midsized town, Kouvola

The city of Kouvola is located in South-East Finland; 130 km from country capital Helsinki, and 230 km from million city of St. Petersburg, Russia. The population of the city is 90 000 inhabitants. The city of Kouvola was enlarged considerably in the beginning of 2009, since five other near-by towns and municipalities were integrated into it. Basically 50,000 inhabitants live either in former Kouvola and Kuusankoski area (please see Figure 3), which together represent typical town area with population density needed for efficient public transportation. Currently 50 daily bus lines connect these two city centers. In some areas population density is one of the highest in Finland. Other parts of the new city can be considered rural areas with low population concentration and rather long distance from each other.

To identify potential light rail routes, semi-structured interviews were made with key decision makers of the city government (inc. mayor, middle management of development etc.). Also quantitative data regarding population concentration, working places and schools was collected. Based on this information the route alternatives were constructed to serve the main city centers of Kouvola and Kuusankoski. Five alternative routes were finally identified for potential use of light rail system, and whole network of these five alternative routes is shown in Figure 1.

- Plan 1 is an oval shaped light rail route (please see Figure 1) connecting functional centers around Kouvola.
- Plan 2 consists of a part of the oval line of alternative 1. The section between Kasarminmäki and Sydänmaantie is removed.
- Plan 3 begins from travel center (down-middle of Figure 1) and ends to Kuusankoski house (middle-left of Figure 1).
- Plan 4 begins in Kuusankoski house and ends in China Center, which is extended version of alternative 1.
- Plan 5 is based on existing railway route to Voikkaa Business Park and district around it (see top left in Figure 1).

Figure 1. Whole simulated light rail network. (M = Travel center, CC = China Center, K = Kasarminmäki, S = Sydänmaantie and 1,2,3,4,5 are railway plans)

Light rail investments assumptions

For calculating with the light rails profitability following parameter values were used:

- Interest rate is 5 %
- Investments life time is 30 years
- Annual benefits and costs remain the same for the total investment life time
- Residual value of train and railway is 25 %
- Plans 1 and 2 will be built in two years
- Plans 3, 4 and 5 will be built in an year

Table 1. Profitability by SM5-train.

Titles NPV, M€	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5
Benefits, M€	7.524	4.914	6.397	9.074	2.562
Environment benefits M€	1.126	0.839	0.707	1.044	0.857
Residual value, M€	2.037	0.779	0.741	0.962	0.444
Total benefits, M€	10.687	6.532	7.846	11.080	3.863
Financing, M€	5.071	1.951	1.794	2.327	1.074
Investment, M€	35.215	13.462	12.814	16.623	7.767
Invesment & Financing , M€	40.286	15.462	14.608	18.950	8.746
Investments NPV, M€	-24.528	-6.930	-4.968	-5.543	-3.809
Cost-Benefit ratio	0.265	0.424	0.537	0.585	0.442

Table 2. Profitability by second-hand train.

Titles NPV, M€	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5
Benefits, M€	7.704	5.048	6.509	9.233	2.692
Environment benefits, M€	1.126	0.839	0.707	1.044	0.857
Residual value, M€	1.740	0.481	0.429	0.649	0.131
Total benefits, M€	10.569	6.368	7.645	10.926	2.692
Financing, M€	4.315	1.195	1.038	1.571	0.318
Investment, M€	30.072	8.319	7.414	11.223	2.272
Investment & Financing, M€	34.387	9.515	8.452	12.794	2.590
Investments NPV, M€	-19.504	-1.951	0.231	-0.297	1.409
Cost-benefit ratio	0.307	0.669	0.905	0.854	1.421

5.5 Real options approach

Real option model is an extension to Net Present Value, which is based on the financial theory. In the model is assumed that the investment has possibilities to the future. These possibilities have a strategic or another value.

In this case energy and environmental cost treated as the real option. Electrified light rail could be substituted diesel-busses in public transportation. The profitability of the light rail investment is improved by increasing energy and environmental costs. Tables 1 and 2 show the annual growth rate of energy and environmental costs needed to compensate for the light rail investment for used and new trains respectively. In this case was it showed that energy

and environmental costs increase from 2 to 20 per cent every year in the 30 years calculation period that it could compensate light rail investments. We assume that energy and environmental costs give approximately a 2-3 % advantage to the light rail compared to existence bus traffic. (Table 3 and 4)

Table 3. Real option by second-hand train.

Title, present value, M€	Plan 1	Plan 2	Plan 4
Environmental benefits an year, M€	0.073	0.055	0.068
Needed growth per cent (%) in year	17.900	9.000	2.000
Real option NPV, M€	19.504	2.790	1.341
Investment NPV, M€	-19.504	-2.790	-1.341

Table 4. Real option by new SM-5 train.

Title, present value, M€	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5
Environmental benefits/a, M€	0.073	0.055	0.046	0.068	0.056
Needed growth-% / year	19.800	14.900	14.100	12.800	11.900
Real option NPV, M€	25.654	7.769	5.675	6.587	4.666
Investment NPV, M€	-25.654	-7.769	-5.675	-6.587	-4.666

5. Case: Real option in the investments of the ports: security of supply of the ports in the shores of Gulf of Finland

Maritime transportation in the Gulf of Finland

The Gulf of Finland is said to be one of the densest operated sea areas in the world, which is also economically vulnerable shallow: the maximum depth is 60 meters and the average depth 37 meters. Petroleum transport share is over 50 % of cargo traffic and its share will be growing up in the future (Finnports 2009). The Gulf of Finland is surrounded by three very different national economies with different maritime transportation structures. Finland has been economically successful: It has had a high GDP for a long time. Finland has many ports in the shores of the Gulf of Finland and Lake Saimaa, in which are handled its own import

and export of cargoes: consumer goods, industrial products, raw materials and petroleum products. Besides that the ports near the Russian (Hanko, Helsinki, Kotka and Hamina) have handled a great deal of the Russian import and export: especially cars and consumer goods (Finnports 2009).

In the latest decade (1995-2005) Estonian small economy has grown enormously, but now growth has gone off dramatically (due to global economic turmoil). Estonian own export consist of forestry products, raw materials and consumer goods. Besides a deal of the Russian petroleum exports has been transported via the Estonian ports. Also cars and consumer products are being transported via Estonia to Russia.

Russia is a large country with huge growth potential. The expansion of petroleum exports has lead to a strong economic and maritime transports growth. Russia has been expanding its port activities in the Gulf of Finland and it is officially aiming to transport own imports and exports through its own ports in the future.

But now these economies have met the deep depression. The future the development on maritime transportation is affected mostly by current economic instability.

Real option in the ports capacity

Growth options have strategy expectation value that effects growth in the future. Growth options are commonly used, when it is needed extra capacity. From year 1999 the growth of the Russian economy (GDP) has annually been about 5-10 % until the year 2008. At the beginning of the year 2008, the growth stopped dramatically, when global depression reached this country too. Before that, it was widely believed that the growth of maritime transit will continue in the future. Many ports of the Gulf of Finland had planned enormous investment plans for the future. The economic situation and the Russian official aim to transport its own import and export through the Russian ports in the future, had turned port investment plans containing lot of risk. These risky investments could be avoided by co-operation with the other ports in the Gulf of Finland.

In this case option to defer investment plans to the better times can be recommended and the reservoir of port capacity is real option: could the Finnish ports be reservoirs of port capacity to the Estonian ports and vice versa could the Estonian ports be reservoir of capacity to the Finnish ports? In Tables 5 and 6 is showed the information of the remarkable ports of the GOF.

Table 5. Infrastructure of the Finnish ports. Source: Finnports (2009)

Port	Area ha	Dept m	Dock m	Warehouse m^2	Field for TEU or cars, ha	Railway, M	Lifts TEU	Lifts other	Petrol/ chemical quays
Hamina	461	10	2 978	384 000	50	37 500	3	1	4
Hanko	141	13	1 800	56 800	72,8	9 900	1	1	1
Helsinki	168	11	9 009	40 000	1 mil. T	12 000	10	2	0
Kotka	624	15	5 214	519 000	90	31 900	0	6	2
Turku	225	10	5 000	199 400	27,8	41 000	1	9	2
Naantali	24	13	1 282	5 723	-	3 325	0	2	4
Sköldvik	-	15	-	-	-	-	-	-	7

Table 6. Infrastructure of the Estonian ports. Source: Port of Talinn (2009) & Port of Sillamae

Port	Area ha	Dept m	Dock m	Warehouse m^2	Field for TEU or cars, m^2	Railway, m	Lifts TEU	Lifts other	Petroleum / chemical quays
Sillamäki	600	12	2 000	18 000	22/90 ha	4000	4	1	3+2
Muuga	524	18	5900	151 000	67 ha	10 000	2	30	3+1
Paldinski	139	13,5	1400	12 000	27 ha	4000	-	3	2

If it compare infrastructure capacity of the ports of Finland and Estonian in the GOF it can be noted that the ports of Sillamäki, Muuga and Paldinski have quite same infrastructure combination that ports of Kotka, Hamina, Sködvik, Helsinki, Hanko, Naantali and Turku. However, the Estonia maritime transportation capacity is a great deal smaller compared to Finnish ports maritime transportation. Only petroleum products transportation from Russian via the ports of Estonian is larger.

In the ports of Estonia are planned several investment plans. A new container terminal with the capacity of 1.3 million TEU with two quays with the length 378 and 420 meters and the depth 14.5 and 16 meters has been begun to build in the port of Muuga. The plans consist also the reconstruction of three berths of the dry bulk vessels and the lengthening of the container berth (Port of Tallinn 2009). In the ports of Sillamäki and Paldinki have been planned more car yards and industrial parks (Port of Tallinn 2009; Port of Sillamae 2009).

Co-operation with Finnish and Estonian ports can avoid or move these extra capacity investments to the later future. Option to defer so called “wait and see” until it have got better information about the development of the Russian economy and its investment to its own capacity of ports in the Gulf of Finland. The value of option will be the designed investments costs to the new extra capacity to the ports of Estonia and Finland. Muuga, Paldinski and Sillamäki ports have large investment plans in the near future. In Finland the designed investment plans to the ports of GOF are smaller. If we estimate that ports generally have about 20 -35 % per cent extra capacity of their operations; it can be saved a deal of the extra capacity costs by using co-operation with the ports of Finland and Estonian in the GOF. It must remark that savings in every single port are almost a deal of its own extra capacity costs, because every port has a different infrastructure and operations.

Ports of Finland		Extra capacity
	+	
Ports of Estonian		Extra capacity
	=	
Ports of Finland & Estonian		Savings in common extra capacity

Figure 2. Extra capacity of the ports of the GOF.

6. Discussion and conclusions

The objective of this study was to evaluate light rail as a local passenger traffic solution for a midsized town. The evaluation was based on investment appraisal methodology. Light rail projects were compared to present state in which public transport is operated by busses. Nowadays buses pay for their use of infrastructure only through fuel tax, and the profitability of the service is determined by operational efficiency and operating costs. Light rail need its own dedicated infrastructure, which is very expensive (Quinet & Vickerman 2004).

One aim of this research was to explore if the benefits of light rail traffic could support the extensive infrastructure needed. This research was made using a public infrastructure project calculation model to ensure comparability of the results.

Based on the results, infrastructure investment of operating network required plays a pivotal role in determining the profitability of light rail public transportation system in a middle sized town. Projects that can be built using existing infrastructure proved to be profitable. The light rail investment can be compared to the existing bus transportation service which is operated using public infrastructure without paying road tax. Based on our results, light rail investments need public subsidy in order to be able to carry the investment costs in a middle sized town. However, light rail traffic is seen fit to traffic connections which have 1,000-17,000 passengers in the peak hours (Alku 2007). Interestingly, environmental issues can't justify light rail investments alone, even if significant changes would appear in operating environment.

Furthermore, in the cases analyzed environment and energy benefits did not have a pivotal role in determining the profitability of railway traffic. In order to affect profitability, environmental and energy benefits must increase annually nearly 20 per cent. This is not realistic, as all transportation models aim at cutting their environment and energy costs. It will be more realistic to assume that environment and energy benefits will give a 2-3 per cent advantage to the electrified railway traffic in the 30 years calculation period compared to the diesel used buss traffic.

In the sum, it can be stated that the development of maritime transportation in the Gulf of Finland is dominated by the development of Russia. For that reason large investments to the new extra capacity of maritime transportation are just now risk able. Although Russia will execute its own investment to the ports, it can be proposed that demand of transit transportation via Finland and Estonian will continue.

Co-operation with Finnish and Estonian ports can be avoided or moved extra capacity investments in Finland and Estonian in the near future. Option to defer so called "wait and see" until it have been elicited better information about the development of the Russian economy and its investment to its own capacity of ports in the Gulf of Finland. The value of option will be the planned investments costs to the extra capacity of the ports of Estonian and Finland. A deal of that sum (real option) can be saved with the common extra capacity of ports infrastructure in the shores of the Gulf of Finland. If we think the security of supply, Finnish and Estonian ports have a limited capability to compensate for each others operations; the ports of Finland handle containers, customer goods and investment products and the ports of Estonian have specialized to Russian petroleum exports.

Further research in the light rail area is at least two-fold; one interesting avenue could be to examine existing light rail systems, and evaluate their efficiency and organizational as well

as ownership forms (macro level investigation). Another avenue would naturally be following the real light rail initiatives further (micro level); how cost objectives were met during construction phase, and how estimated travel amounts develop in the real system and do our estimations from operation costs appear to be realistic. Especially in Europe retired people do have increasing need for transportation, and this could be one potential driver for light rail, as people move increasingly in the higher population intensity areas, where there exist all the services available. In this research real options can be based on possibilities of new banners profitability to start operation.

The development and enhancement of Finnish ports requires also development and increased use of rail transports. Rail transit can also be seen as a part of a national route and steps of development in rail volumes competitiveness of the Finnish transit route. However, this requires integration of services that should be available as a single package. Further research in this area would be possible in more integrated service models. Real options can be a payback from an investment in these kinds of co-operations.

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Research Note: Strategy and scenario of development for Urals container transport system

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USURT

Due to the economic opportunities, Russian Federation returns to a large transport cooperation in the sphere of international transportation. The important role in this cooperation belongs to Finland that has such competitive benefits as an access to sea routes and the same railway track width as wha is used in Russian Federation.

“The Strategy of railway transport development in RF up to 2030” mentions new large transport projects that are closely connected with the Urals macro region. Over history and in prospective the Urals region was and is a specific middle type region. There are old industry districts and infrastructure nodes that serve the economic development of eastern RF regions.

Figure 1. Urals transport complex in the system of international transport corridors

The Urals Federal District which consists of Sverdlovsk, Tyumen, Kurgan and Chelyabinsk regions is one of the engines of RF economics industrial development. The main

branches that provide economic growth are situated on the territory of Sverdlovsk and Tyumen regions and represent gas-and-oil producing industry, heavy engineering, metallurgy, food, chemical and building industries. One more serious challenge is arising at the moment. There is a goal to develop the Urals railway infrastructure and to develop particularly container service. That is why it is so important to organize a container train connecting Ekaterinburg and Kouvola. We have to mention that INNORAIL project has already made work with this regard. However, we have more work to do.

First of all, we have to make a freight flow analysis in a whole and also freight flow analysis of container transported goods in Sverdlovsk region taking into account different means of transport.

The second important issue is a tariff analysis and development of our own competitive tariff.

The third question is connected with our transport policy. One company can not gather the necessary number of containers. Companies should become partners and not competitors. There must be a coordinator, and we should also create an organizational and technological interaction mechanism.

One of the main factors that influences on container freight flow growth in Russia and in the Urals Federal District is region's stable economic development. The greater part of all country freight formation is done at the Urals and Siberia regions. More than 70% of country's freight base is formed to the eastern direction from the Volga River. The transit flow goes through the Urals from East to West. Mainly, it is coal, metal, oil and chemical goods. The growth rate of industries and loading at the Urals is the highest in RF. As for goods transported in containers by Sverdlovsk Railways we found out the following structure for them:

- Production of agriculture industry
- Production of forest, woodworking and pulp-and-paper industries
- Metal ores
- Production of fuel and energy industry
- Minerals, building materials, abrasives
- Production of metallurgic industry
- Production of mechanical engineering, instrument engineering and metal-working industry
- Production of chemical industry
- Production of food industry

- Production of light and printing industries

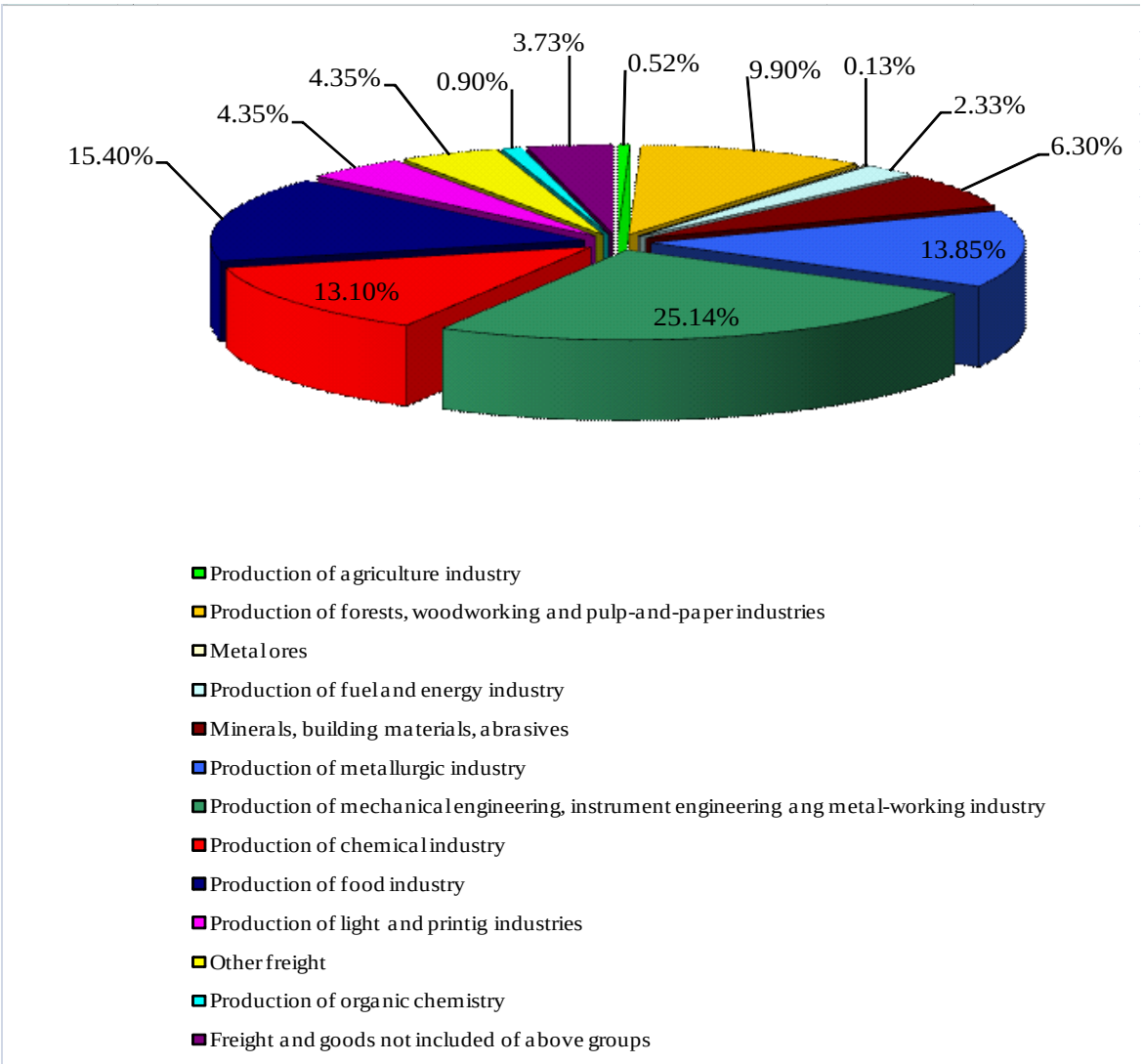

Figure 2. Structure of goods transported in containers by Sverdlovsk Railways

The largest per cent of all transported goods is for production of mechanical engineering, instrument engineering and metal-working industry. According to railway tariffs these goods belong to a third tariff class and form 82% of goods belonging to other tariff classes and transported in containers. About 50% of freight flow goes through the Urals to the European part and towards ports and land crossings.

Sverdlovsk Railways are searching for effective methods of transportation control and such segment of cargo transportation market as container transportation. That is why cooperation with a business park INNORAIL Kouvola will increase competitive ability of this market segment.

At present time in Russia there is a tendency that traffic volume for middle tonnage containers is decreasing and traffic volume for large tonnage containers is increasing. However, the container depots that were formed by the end of 80's remained the same and the stations that are ready for operations with middle tonnage containers prevail. Due to this situation majority of container depots become ineffective.

Considering irregularity of container depots, their different significance and different potential for forwarding services the authors have made a systematization of Russian Railways container depots according to qualitative criteria for market demands in order to determine approaches and directions for their reformation. The authors took into account the operation needs in transport corridors East-West and North-South, and also the necessity for direction specialization of container trains formation in freight formation centers. On Sverdlovsk Railways there are more than 50 stations that can work with containers, but only 6 stations perform the main work load.

Analysis of container freight flows in the Urals Federal District for the last ten years showed that loading of large tonnage containers has doubled and loading of middle tonnage containers has decreased on 1.33. We can explain this tendency for freight transportation in large tonnage containers by economic factors, because freight transportation in large tonnage containers lets reduce transportation costs.

It is necessary to point out that renewal of technical base influences very much on further development of container transportation. Due to the growth of transportation in large tonnage containers and decline of transportation in middle tonnage containers large freight owners have to change their working scheme, widen and diminish container areas, automate paper work process and renew cargo handling equipment.

It is important to forecast the container transportation volume for the further period of time. In each particular case an optimal forecast is chosen after analyzing the state of product markets, distribution channels, methods of transportation planning.

The changes in container transportation volumes demand correction in number of container terminals for operation with middle and large tonnage containers.

For example, in 1980s at the Urals middle tonnage containers were to large tonnage containers such as 70 to 30, and in 2008 as 23 to 77. Taking into account this tendency the authors make other calculations basing on proportion that middle tonnage containers are to large tonnage containers as 20 to 80. So, when we organize the container train Ekaterinburg – Kouvola we should put an emphasis on large tonnage container transportation.

The aims of huge transport projects at the Urals are connected with the desire to use geologic and economic potential of middle regions. As a result these regions should get a whole range of transport communications in order to realize their integral and transit role. Nowadays it is a very urgent purpose to organize the container train running between Ekaterinburg and Kouvola.

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Research Note: Developing of the railway passenger options between Russia and Finland

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Abstract
Developing of the correspondence of volumes of passenger traffic between Russia and Finland is the main theme of this article. But also quite interesting is to look to the new routes through different border crossing points.

Keywords: Passenger transportation, new directions, progress of accommodations

The demands of the European commission suppose elimination of technological and legal contradictions between railway systems of the different countries within the limits of separate transport corridors. Such as uniform legal space means that on each separate site of a route introduce the same rules of law and technical standards that engineers a total transport corridor (OSJD 2009). Developing of transport corridors will lead to increase the direct correspondence of transport streams, including passenger. Railway communications in Russia and Finland have an identical track of 1520 mm, therefore in technological questions interaction between the RZD and VR is much easier; compare to others railways in the Europe. Results of work of Contact group of the Organization for Cooperation of Railways (OSZhD) under the comparative analysis of technical parameters of systems of 1520 mm and 1435 mm have allowed to recommend to the European Commission include railway system of a track of 1520 mm in developed Technical Article descriptions of Interoperability (ERA) on a level with system of a track of 1435 mm. It testifies that EU from its part recognizes necessity of inclusion of system of a track of 1520 mm in EU legislation.

The passenger reports between Russia and Finland occupies the first place among of the total amount of transportations in the international reports with the countries of the far abroad and makes in Russia of 49 % following the results of work of 2007. In total in 2007 St. Petersburg – Helsinki have taken advantage of the international rail traffic about 230 thousand passengers. In comparison with previous year the quantity of trips has grown on 15 %. If decrease in a volume of passenger traffic in Russia from the beginning financial and an economic crisis of 2008 makes more than 10 % in the Russian-Finnish through railway service growth of transportations is observed even.

Constantly trains go to Helsinki only from Moscow and St. Petersburg. The Russian-Finnish rail traffic gives possibility to go to 22 districts of Finland, using favorable discounts.

Discounts for tickets reach 40-60 %. Accomplish tickets in Helsinki, Kajaani and Rovaniemi More often. In drawing the sample of the ticket is presented to Oulu accomplished in St.-Petersburg.

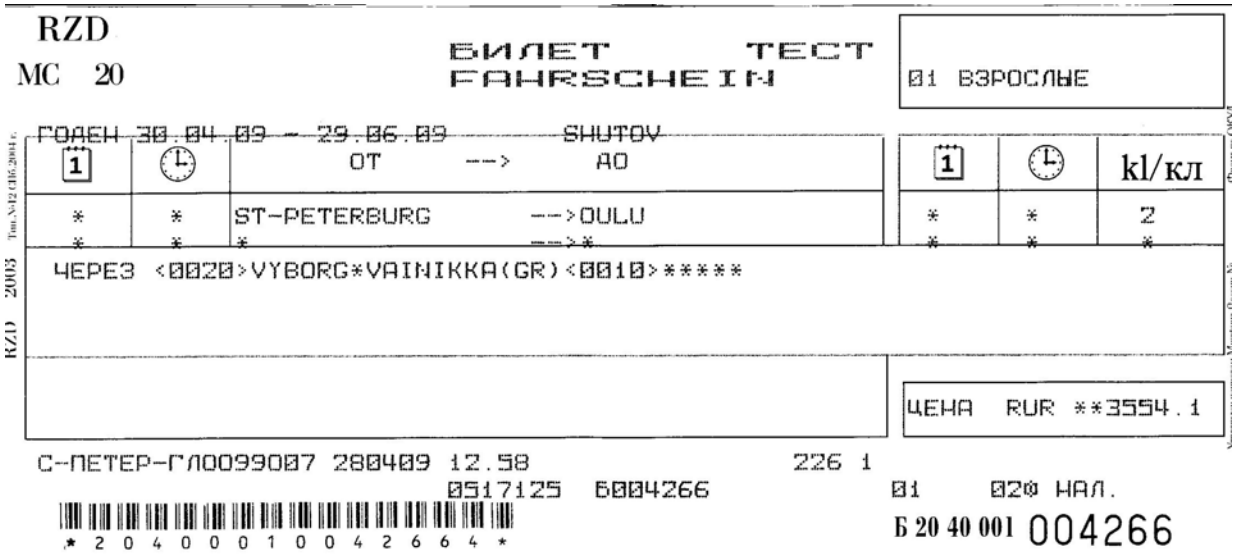

Figure 1. Example of the ticket Saint-Petersburg – Oulu.

In days of a New Year's and Christmas vacation special (charter) trains to stations Rovaniemi, Kajaani, Kuopio, Joensuu are appointed. The number of trains of such appointments grows, despite crisis.

During the period connected with celebrating of Christmas and New Year (15.12 – 15.01), a volume of passenger traffic between Russia and Finland grows. Growth in comparison of 2007 with the corresponding period of 2008 is reconciled in the table.

Table 1. Passenger traffic between Russia and Finland.

Volume of passenger traffic	Titles of trains		
	Sibelius	Repin	The additional
2007 г.	12317	13667	24453
2008 г.	13225	13928	26153

Thus, growth of number of trains through boundary transition Buslovskaya – Vainikkala is caused on 3.6 %. In work on development of tenders on developing passenger with-dialogue together with the Finnish railroad communications questions, which concern as new routes already known and habitual available trains and new marketing tenders are discussed. So, development of a new passenger route Petrozavodsk – Turku, for example, is offered. As

innovations can offered inclusion in railroad train of a train of rail cars-garages and the delivery of the passenger by bus from a final railhead to destination without an additional payment, etc.

Development of a route from Petrozavodsk is connected with the tenders of Karelia's government about the provision of the passenger traffic through boundary transition Värtsilä – Niirala.

Demand for trips to Finland is great enough. Also it was considered that in Karelia there are Kizhi and a Valaam monastery, which are interesting for foreign citizens. Besides, demand for a route will be determined for all Northwest region of Russia.

The choice of Turku as destination speaks that is a city-port, an administrative centre of the West Finland, the former capital of the country, and also economically developed region with the powerful cultural complex. Using an offered route, the passenger can plan the further travel to Europe, and at desire to continue it on the ferry. On a course of following of a train the cities of Suojarvi, by Maaselkä (in 20 km from Sortavala), Joensuu, Kuopio, Jyväskylä and Tampere, which is second-largest city in Finland. Tampere – one of the largest tourist centers in Northern Europe. The main competitor in these is the motor transport; the majority of passengers use buses. Further considering business activity of the population and absence of the trail traffic from Petrozavodsk abroad, it is possible to draw a conclusion that competitiveness of the October railway in this region is unreasonably low. At a putting in operation of an offered new route the situation will change, because the essential part of a volume of passenger traffic will pass to railway transportation. To my mind the courses of that are following serves:

1) At the travel to a train of less time it is spent on at border crossing as visa and customs formalities are carried out during train traffic. It essentially reduces time in a road;

2) The Passengers prefer a trip to a train as more comfortable and organized, unlike unpredictable travel to the bus;

3) Mentality of Europeans does not allow them to travel by the bus. For distant trips they trust own cars, planes and electric trains more.

The new tender on inclusion is connected with the last thesis in the railroad train of a train of rail cars-garages. This innovation will promote to the inflow of the passengers from abroad since they prefer to travel on a privately owned vehicle and to leave it is not necessary. Customs registration of a vehicle (car) can be compelted before train departure, which will essentially reduce time necessary for crossing of border.

Also the tender on inclusion in cost railway the tariff of such service, as delivery of the passenger by bus from station in destination is interesting. For example, having arrived to Petrozavodsk by train the passenger can get to Kizhi (with-out changing the operator and without having spent additional means). «The status of a member of Conference allows us not only free to perform international rail transportation of cargoes and a passenger, but also to participate in making up of a uniform legal field in the international railway cargo and passenger reports», – The president of Open Society «Russian railroad communications» Vladimir Yakunin at plenary session has noted XXIV Conferences of general directors of Organization for Cooperation of Railways OSShD in Moscow (Russian Railways 2009). Thus, developing of the railway civil passenger traffic between Russia and Finland is predicted not only on the basis of high-speed traffic between St. Petersburg and Helsinki between, which it is conducted modernizations infrastructures for traffic with speeds to 200 km/hour.

The interesting new prospects are possible at the expense of an alternative routes and a granting of the service services.

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Research note: Crisis – challenges for logistics business and management

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Global crisis, starting from financial crisis, have touched already a lot of industry branches. The main of areas, being covered by crisis and met difficulties, are:

Constructing (building);
Metallurgy;
Automotive industry; and
International load transportation and logistics.

This situation can be affirmed by few examples:

1. Nearly 50% of building sites in Saint-Petersburg were stopped in March 2009 ;
2. as declared one of the NISSAN company CEO "2007 cars selling level would be restored no earlier then 7 years ";
3. Load transportation volume through Russia-Finland cross-border points Torfyanovka /Vaalimaa; Brusnicnoye/Nujamaa; Svetogorsk/Imatra in November 2008 was equal to 62% of November 2007.

In tune with the item of this article below is shown an illustration of financial crisis roots (see Figure 1). Obviously, emphasized by red (cursive) roots of financial crisis are valid as reasons of difficulties in activities of any company, as well as logistics ones.

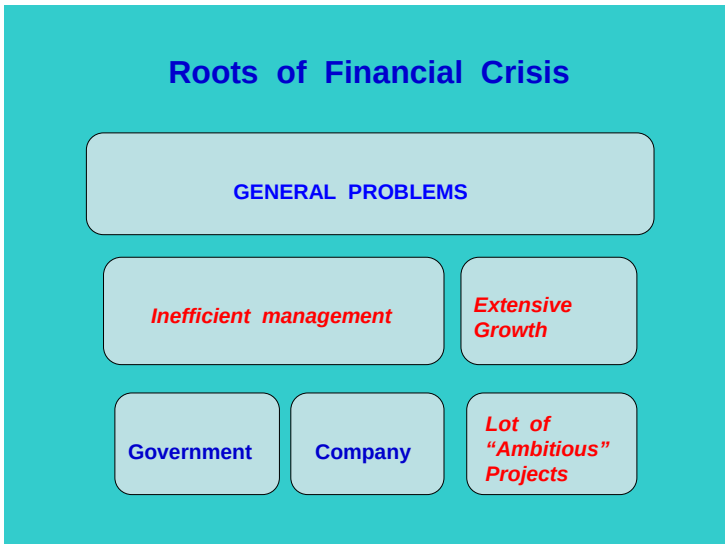

Figure 1. Roots of financial crisis.

It therefore naturally opens following question: "*What to do now ?*", "*What measures can be attracted against crisis?*", "*What must be done to make things better?*" There exist three alternative directions:

1. Let it be as it is
2. Jack out everything and find new occupation
3. Overcome non-optimal situation.

We choose the third one and shall try to propose some measures for its realization.

First of all top-management ought to revise corporate strategy in new conditions dependent of crisis development. In literature one can meet three main strategies, which are widely used in practice:

- Strategy of Growth
- Strategy of holding market positions
- Strategy of retirement (breakaway)

In compliance with revised corporate strategy must be renewed the logistics strategy of the company. As usually it can be accentuated several logistics strategies:

1. General logistics expenses minimization strategy
2. Logistics service quality improvement strategy
3. Logistics infrastructure investment minimization strategy
4. Logistics outsourcing strategy

Each of these have there own constituents (see Table 1 below).

Table 1. Different logistics strategies.

Expenses minimization	**Quality improvement**	**Infrastructure investment minimization**	**Outsourcing**
reduction of operational expenses for separate logistics functions; inventory optimization; optimum choice variant « warehousing-transportation»; using of 3PL approach	logistics operations and functions quality fulfillment improvement; logistics support for services before and after sale; value added logistics service; logistics support of products life cycle; quality management system creation; ISO 9000 certification of this system	optimization of logistics net; customers goods direct delivering; usage of general access warehouses; usage of logistics providers in transportation, storage and LO/LO; usage of “just-in-time” technology; logistics infrastructure objects dislocation optimization	« to make or to buy» decision; key functions self concentration – 3PL approach for secondary functions; optimization of external sources of resources; usage of suppliers investment and innovations; number of agents (brokers) optimization

Anyone can chose appropriate for his needs strategy points, but our opinion is, that for Russian (and may be not only for Russian) companies in crisis conditions very important “infrastructure investment minimization” events and advantage of outsourcing development.

It have to be noticed, that logistics is 100% dependent of economics development, and therefore we can’t regulate the demand volume of logistics services market. This is unwanted feature in recession. From other side logistics deal with flows and supply chains, so possess the optimization methodology. So, it is an earnest for logistics companies to overcome in better manner negative influence of crisis.

As an example of reducing costs and increasing efficiency of operations by innovative technologies can be demonstrated implementation in container transportation a new scheme, when empty container doesn’t return to “mother” terminal, but directly delivers to local exporter, not loosing time for additional transport operations (see the Figure 2)

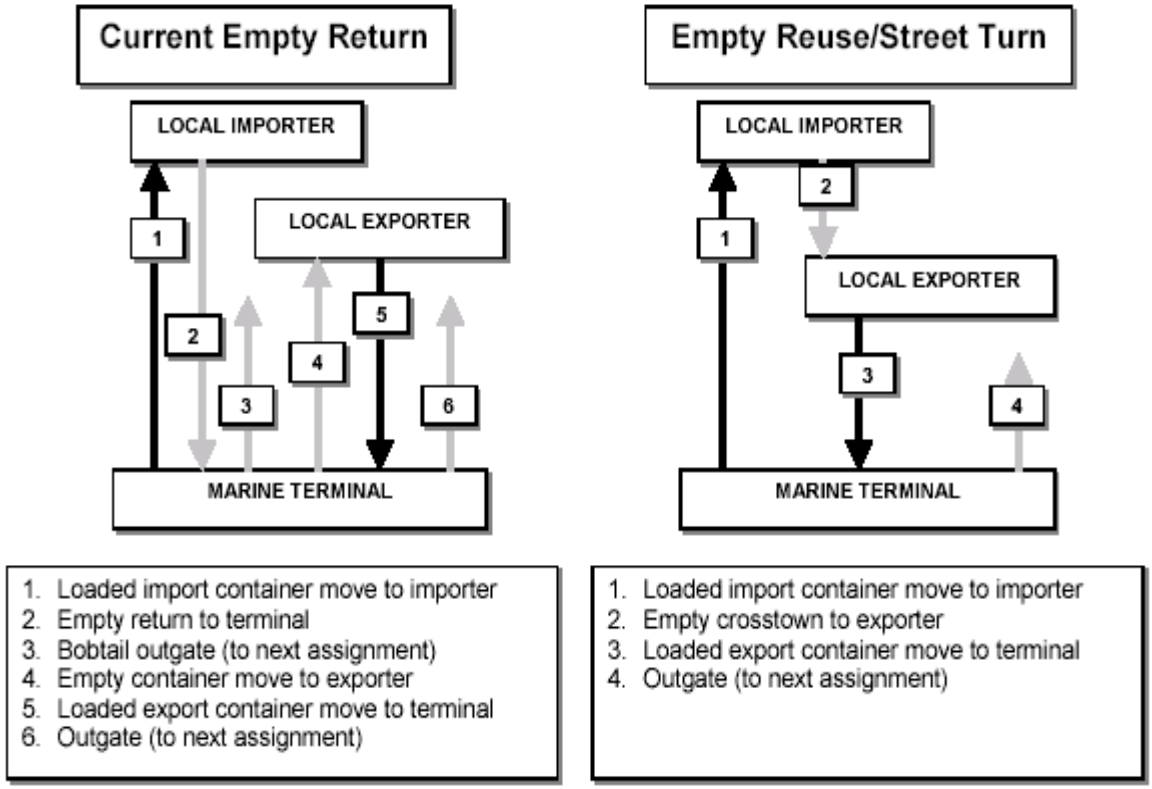

Figure 2. Proposed empty container management model.

Shortly summarizing the above discussions for preventing and confronting negative crisis manifests following measures for logistics companies and logistics departments of Manufacturing and trade companies can be proposed:

- Renovation of Strategy
- Reduce of inefficient links in logistics system
- Implementation of up to date technologies
- High competence staff
- Contemporary education tools (distance)
- Networking and outsourcing

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Research Note: SAP options for the transportation companies and logistic service providers as used at OAO "RZhD"

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At present, the Russian transportation market is developing intensively running at a rapid pace the path, which took decades for the international cargo transportation market to go through. The major consequence of this it is the creation of companies that are providers of logistics services and that assume all functions of the client companies relating to the procurement of the enterprises and marketing of their finished commodities enabling their clients to focus on the main kinds of their activities. Logistics service providers have to deal with large amounts of information managing the procurement chains including the client company, its suppliers and consumers, as well as the executives at individual links of the chain (forwarders, carriers, storage and terminals operators, ports and stevedoring agencies). Provider makes stringent demands to the executives regarding the quality, value and informational support of the services provided. For all players at the market, the skill to work in the real-time mode, to manage the information flow, to integrate data, to reduce costs, and to increase operability are becoming the principal competitive advantages.

SAP Corporation offers to the players at the market of the transportation and logistic services a fully functional solution for the industry where a huge international experience of implementation of numerous projects in the industry has been implemented.

With this, a comprehensive solution to carry out all business processes for the transportation agencies in the industry is provided: carries by different modes of transport, forwarders, storage and terminals operators, and the companies that extend comprehensive logistic services. This solution will make it possible to improve the quality of short-term and long-term management, to reduce costs, and as a result to increase the competitive ability of a company due to granting its customers a new quality of service level to a packaged solution to the transportation and logistic problems.

The SAP option allows the companies to obtain a full image of relationship with every one of their customers. In the framework of the SAP option for the transportation companies of the industry, there are specialized components to manage the individual elements of the company' own infrastructure in order to organize the freight traffic and render transportation and logistic services.

SAP Corporation offers a fully functional option for the storage management making it possible to implement the entire range of ingoing, outgoing and internal business processes related to the modern storage complexes management. Integrating of these systems within the framework of the solution regarding the transportation companies and logistic services providers in the industry makes it possible to integrate the storage spaces and terminals into a single planning, organization and procurement chains management system.

Functional capacity of the SAP option for the industry makes it possible to keep records of the transit by rail freightage and rendering of services in any certain delivery stage, integrating various instruments and data on status and events while carrying out the customer's order in order to control the quality and time of the comprehensive delivery services.

The SAP option includes the basic interindustry components that make it possible to fully carry out the management processes and to ensure the major infrastructure processes at a modern enterprise.

The SAP option is not only to improve the current indices of the company's activities but also it provides with a long-term commercial success.

The SAP business solutions are being used by more than 350 transportation businesses and logistic services providers all over the world. And the largest project is the use of the SAP option at OAO "RZhD".

The rail industry is one of the few in the Russian economy, where they managed to achieve an international level of the information and engineering support on the basis of the advanced technologies of the financial and economic activities management. Currently, there are two major ERP systems running at OAO "RZhD" – EK ASUFR, the financial and facilities and equipment management system, and EK ASUTR, the human resources management system. The both systems have been built on the SAP platform, the world's leader in the development of the corporative information systems for the management of large and medium enterprises.

With the help of EK ASUFR, the OAO "RZhD" specialists control, in the real-time mode, all key indices of the activities in the field of finances, property, supplies of materials and machinery, etc.

The OAO "RZhD" personnel management (it means more than 1.3 mln people) is carried out through EK ASUTR system that provides with the functions of work quota setting, working hours tracking, payroll accounting, etc.

The projects are unique sui generis, and actually there are not counterparts the world over regarding both the scope (area, time zones, and number of users) and the amount of

operations. Productive record keeping systems are all over Russia, having in the centre a number of systems for analytic storage of information covering the entire OAO "RZhD". According to the experts, the EK ASUFR implementation at OAO "RZhD" is one of the major projects based on SAP R/3 both in Russia and Europe.

At present, the project involves more than 3,000 enterprises and 15,000 structural sub-divisions all over the nation; the number of its users exceeds 50,000 people (17,000 users with the central systems and 33,000 users with the road systems).

When designing and implementing EK ASUFR, it was necessary to apply some special designs in order to ensure that the system would provide the OAO "RZhD" CEO's with a high quality and reliable information after its commissioning.

For instance, one of the major principles assumed as a basis when creating EK ASUFR was a centralized keeping of the regulatory and reference information (TsNSI). This design made it possible to avoid risks and needless costs concerning the inevitable synchronization of data derived from various sources.

Another important design option is to use the principle of the centralized development when creating a standard road system (TDS), one of the key EK ASUFR sub-systems. This system is installed in all OAO "RZhD" territorial affiliated branches (17 railways) and provides with the primary record-keeping of all economical transactions in the sphere of finances and supplies of materials and machinery in every subsidiary's enterprise. The development and upgrade of all system is carried out through the unified central development system in Moscow, at the OAO "RZhD" main computation centre. All and every upgrading is to pass the quality inspection at the Centre, and then it is replicated for the road systems. During the last two years, a subsidiary system functionality to cover the need of the other OAO "RZhD" subsidiaries (not engaged into the carrier's activities) has been carried out on the TDS basis.

A Human resources management system's (EK ASUTR) particular feature is both the processing of a huge amount of data and the amount of the implemented functional that fully involves all human resources management aspects.

OAO "Russian Railways" is the world's largest rail corporation regarding the personnel, flow of traffic, and the length of the electrified lines. It is an enormous enterprise with a vast number of affiliated branches and subsidiaries, etc. Any from top to bottom data collecting is an enormous work that is a hard load to the computing facilities and this is to be taken into consideration both at the selection of the said computing facilities and in the development and implementation. All the projects under implementation consider such special features in the

enterprises' work as a simultaneous work time of tens of hundreds of users, an assured uninterrupted operation in the real-time mode, an eventual system extension and an increase in the engineering and functional potential.

A rather big number of computer-based systems providing with the functions of traffic management, engineering resources planning, and settling for freight and passenger service operate efficiently at OAO "RZhD". While creating EK ASUFR and EK ASUTR systems the stake was on the implementation of interfaces for these systems in order to ensure a uniformity of the OAO "RZhD" computer-aided system (ASU OAO "RZhD").

Among the current projects, one can highlight the completion of EK ASUFR and EK ASUTR integration with other information systems that function at OAO "RZhD", such as ETRAN (computer-based system for the shipping documents drawing), "Express", Consolidated analytical transportation recording system, etc.

The concept of creation and extension of the analytical information storages based on SAP BW that makes it possible for the CEO's at different levels to get the analytical data on to the record keeping of the economic activities, to carry out the planned vs. actual analysis, etc. is developing favourably. And it is a topical task for such a big corporation. It is no secret that big organizations are under a close surveillance on the part of the government controls from the point of view of correctness and reliability of the statements to be submitted. It is natural that when creating similar analytical storages, they use the data from all OAO "RZhD" computer-based systems the development of interfaces for which is very topical.

Another very important point is following: Integrating different systems it is to remember about the creation of the centralized bank of the regulatory and reference information that should be uniform within all systems and at all levels. Nowadays, the same object can be defined in different ways in different systems. For instance, a great variety of railcar types operate on the railways. Every railcar should have the same standard name in all systems; only then, having consolidated the data referring to this type of railcars,we'll get a reliable report "at the output".

Currently EKASURF is being transferred to a new engineering platform – SAP ERP 2005 (EK ASUFR-2), which when compared with the former software generation – SAP R/3 – is more flexible, more universal and more scalable and includes powerful integration features. The new platform will make it possible to involve a vast range of long-term, middle-term and short-term planning and budgeting, integration with the information systems both at OAO "RZhD" and other organizations. The changeover to a new platform, SAP ERP 2005, is another important project in the sphere of automation for OAO "RZhD".

Originally EKASUFR was based on the SAP 4.0 platform, EK SUTR on the SAP 4.6 version and the ERP 2005 platform is the SAP software most recent version. Certainly, this version has been upgraded when compared to the previous ones, and its implementation will have its favourable impact on the system operation as a whole. For instance, SAP 4.0 version did not included certain functions indispensable for OAO "RZhD" and that is why some elements of the system had to be updated using the internal language (AWAR). The new system version many things are made according to the standard.

The OAO "RZhD" CEO's have put a target not only carry out the changeover to a new platform but to expand it, including new sections into the EK ASUFR-2 coverage, for example, repair and maintenance management.

The Project, or more exactly the Programme made up of a set of projects is to be completed in 2009. During this period a system's target functionality should be carried out, the process of its implementation at all OAO "RZhD" subdivisions should be completed and the existing record keeping systems should be replaced.

During the current year the basic system's tuning is to be carried out, and the system test running is to take place at a chosen polygon. The switching over to the other system version is supposed to be labour-intensive and the project's global scope would be felt.

The EK ASUFR functionality is not a mere replication of EK ASUFR and EK ASUTR, but a completely novel approach to create a SAP-based system within the framework of a single ASU OAO "RZhD" and it is in this direction that the project would evolve. In the nearest future, some new technologies such as SAP Master Data Management to manage the regulatory and reference information are supposed to be implemented. Now the things that the specialists had to develop on their own in the EK ASUFR previous version are carried out through the standard SAP applications which also ensure the transfer of this TsNSI to all outer, in relation to EK ASUFR-2, OAO "RZhD" systems.

The implementation of all formulated tasks will result in the formation of a OAO "RZhD" single integrated information space which will serve as a basis for the creation of an effective corporative management system. Because the SAP corporation option has accumulated the experiences and the best business practices of the world's most successful corporations, it has been selected as a basis for the rail industry automation in such advanced countries as Germany, Austria, Italy, Portugal, and Denmark.

IT outsourcing in supply chain management (Russian railways case-study)

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Abstract
The paper shows strengths and weaknesses of modern Russian railway IT solutions according to clients answer on completed questionnaire. Also short analysis of opportunities and prospects of use of technology of outsourcing for formation of an IT infrastructure of a supply chain is presented (especially in railway transport). In this paper a review of kinds of IT outsourcing, features of ASP technology (Applications Service Providing), merits and demerits of ASP are being discussed. Also the paper presents examples of successful ASP decisions for logistics and supply chain management in general.

Keywords: ETRAN, IT solutions, e-commerce, ASP

1. Introduction

Now to a question of developing of the market of an information technology in Russia steadfast enough attention is paid. Interest to technology of IT outsourcing grows in process of developing of logistics and making up in the market of the consumer of the difficult integrated structures of goods distribution and a type administration of supplies 3PL and 4PL. In an administration of supplies, especially in network execution, all advantages of technology ASP (Application Service Providing), can be shown by being version of IT Outsourcing. Experience of the USA testifies to it, Great Britain and other leaders in the economic and technological relation of countries of Western Europe.

Transition on ASP assumes integration of information resources of all participants of a chain of deliveries on one technological platform – a platform of the provider of ASP-services that promises serious competitive advantages and provides exit possibility on new, advanced forms of the organisation of business processes on the basis of confidential relations between all participants of a network of deliveries, including ASP-providers and ultimate consumers. Realised on the basis of classical outsourcing, this technology as well as possible answers modern, market concepts SCM focused on active confidential interaction and CRM.

Leasing and outsourcing of information resources from the point of view of classical outsourcing, any not the basic in making up of the value of the company function should be transferred outside, specialising in this area, to the executor (provider). In the modern companies information systems, as a rule, are organically twisted in business processes. In this case on IT all management is based and it is difficult to designate "basic" and "minor" (transferred to providers) business functions. In the absence of turst in relations with the IT provider, the risk loss of controllability because of problems in a qualitative supply with

information can be very high. It constrains distribution ASP. Moreover, to 35 % of agreements on transfer of IT Functions to providers do not renew or stop ahead of schedule. Differently, market appeal ASP is closely connected with the trust and commercial interest of the provider in success of business of the client. Basic difference of outsourcing from routine leasing and traditional technologies of rendering of services of type consists that he assumes active strategic cooperation (partnership) between the provider and the client in creation of additional value. Moreover, outsourcing is considered by participants of the project as an effective way of creation of competitive advantages and achievement of success in business. Classical leasing or service it is simple sale of services. Value (value) at the buyer of these services can and not increase that is rather characteristic for ASP-projects in the conditions of not enough developed market of the consumer.

2. Risks, problems and success factors

Outsourcing (and, in particular, IT Outsourcing) is seldom applied in the form of an innovation under own initiative. Routinely it is completed under the pressure of the market circumstances, forcing to search for new ways of maintenance of competitiveness. Most actively IT Outsourcing is used by the large companies (more than 1000 persons of the personnel), working on innovative and highly competitive the markets. The basic motive thus routinely is the desire sharply to reduce quantity of providing departments, services and departments, to concentrate on the cores for the company business processes and strategy problems. Besides expenses on ASP to supervise much easier, than in own structures. The following can be additional motivators:

- Limited IT Budget or desire to lower the investment in IT;
- There are problems with attraction of the highly skilled IT Personnel for the full-scale automation of management necessary for an exit on a new level of development of business;
- Insufficiency of own IT Resources for satisfaction of quickly growing requirements of clients (risk loss of clients and positions in the market because of insufficient rates of developing);
- There is no time for creation of own IT Resources answering to the purposes of strategic developing, at a severe need of increase of a degree of service of consumers; and

– Fast and essential growth of the property identification of the goods and services at a severe need.

3. Case Study Analysis of JSC RZD System ETRAN

Railway and sea transport including seaports – it those branches which always were strategically important objects and is certainly necessary constant perfection of an information technology on transport and at interaction between its different kinds.

Company "Intelleks" developed the automated system of the centralised preparation and registration of transportation documents ETRAN (the Electronic Transport Waybill). The system is based on principles of use of electronic document circulation at interaction of the client (the consignor, the consignee, and the freight forwarder) and railroad communications for the organisation of shippings goods. ETRAN allows to include the client in a work cycle of a demands acceptance and registration of transportations, namely – it has an opportunity to accomplish the shipping request and to see its current status, to prepare an electronic waybill, to receive summary documents, to plan expenses for the predesign account carrying payments, to watch cargo in a road to a mode of real time and all it – from the computer. ETRAN has excluded errors in calculation of transport payments, which have been connected with manual input of transportation documents, and has much more saved time of registration of transportation. At system engineering requirements on protection of the confidential information have been considered.

For realisation completely paperless technology of document circulation, transition to the digital signature which is analogue of the autographic signature is necessary. Electronic document circulation with digital signature assumes use of the Federal law on the electronic digital signature which has been accepted by the State Duma on 13th of December 2001, is approved by the Federation Council on 26th of December 2001. The electronic digital signature – requisitions of the electronic document, intended for protection of the given electronic document against a fake, received as a result of cryptographic transformation of the information with use of the terminated key of the electronic digital signature and allowing to identify the owner of the certificate of a key of the signature, and also to establish absence of distortion of the information in the electronic document. The idea, which bears in itself introduction digital signature, is significant enough for electronic documents as allows re-using definitively a paper kind of the carrier and by that much more to reduce time of registration of transportation documents.

At carrying out of the analysis of possibilities of system ETRAN following lacks are revealed:

1. Informing on the rail cars sent in port with export cargo is not realized, e.g. for the reason that ETRAN gives the chance to see rail cars only to one real consignee.
2. Also there is a problem of registration of transport waybills on sending of import from port:
    - As the port acts as the guarantor, i.e. the consignor on the instructions of the forwarding company also workplaces in ETRAN should coincide with quantity of these companies. By sending among freight there exist obstacles for registration of cargo which goes under the customs surveillance;
    - In system ETRAN there is no electronic kind SMGS (the agreement on the international cargo traffic), electronic vising cannot be performed, thus before the termination of railway registration at listing on the document appears a word "sample" and, thus, – it is an obstacle for customs registration; and
    - By data for October 2007 the section about sending over waybills in ETRAN "is temporarily disconnected".
3. In system ETRAN the paperless technology is applied to the coordination and a demands acceptance on departure of cargoes; the exception makes the coordination transporter higher.

4. Conclusions

Consolidating of the management information system of ports with information systems of JSC RZD and their integration into a uniform information field would be most convenient on the basis of system ETRAN. Now the exception at least some lacks of this system and complex decisions on software perfection, for example occurrence in ETRAN electronic kind SMGS (the agreement on the international cargo traffic) and electronic access, partially would change a situation of a problem of introduction of this automated system in a port complex. It can become solving step to improvement of quality of technology of document circulation between the railway and a port complex.

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