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**Key performance Indicators for Maritime
Transport System:
A Feasibility Study on Swedish Maritime System**

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ABSTRACT

In the last years the overall trade between Sweden and rest of the world has increased dramatically according to UN. The development of foreign trade has motivated Swedish Authorities to have in-depth knowledge about the degree of accessibility of important locations in Sweden for containerized trade. In parallel with this development, Swedish Maritime Administration has stressed the importance of starting a study to find out some key performance indicators for accessibility. Thus, we will try to examine the accessibility concept in terms of only cost and time for container transportation in different transport relations between a number of places in Sweden and abroad.

The aim of this study is to discover the possibility of having a solid methodology to monitor development of costs and time in the transport relations in order to gauge accessibility of defined locations.

The research is exploratory and based on qualitative observations including interviews with related parties.

Theoretical findings and results indicate that besides offering some basic benchmarking ways for the routes, companies and over time periods —touching many ocean freight providers to Sweden with this approach—, it is understood that having a clear indexing system in liner shipping by only looking to costs and times is not very feasible because of nature of container freight market. Another main problem is the poorness of feedbacks to the questionnaire that we have used to gather core data of the subject as only four of twenty three companies partly answered the questions. The recommendations cover broadening the factors of accessibility, some other data gathering methods, the ability of governments' cooperation on information sharing and benefiting from large market research companies.

Key-Words: Key Performance Indicators, Container Shipping, Sweden, Time, Cost, Measurement

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ABBREVIATIONS

3PL: Third Party Logistics Service Providers
ACL: Atlantic Container Line
BAF: Bunker Adjustment Factor
BDI: Baltic Dry Index
BSR: Baltic States Region
CAF: Currency Adjustment Factor
CIF: Cost Insurance Freight
DEA: Data Envelopment Analysis
DOT: The State Department of Transportation
ESC: European Shipping Counsel
ETA: Estimated Time of Arrival
ETD: Estimated Time of Departure
EU: European Union
FAK: Freight of All Kind
FCE: Fuzzy Comprehensive Evaluation
FEU: Forty-foot Equivalent Unit
FOB: Free on Board
FTA: Freight Transport Association
ISO: International Organization for Standardization
JIT: Just in Time
KPI: Key Performance Indicators
MARAD: The Maritime Administration in United States
MSC: Mediterranean Shipping Company
NVOCC: Non-Vessel Operating Common Carrier
NQS: Northern Quality Shipping
RORO: Roll on Roll off
SMA: Swedish Maritime Administration
SPI: Service Performance Indicators
TEU: Twenty-foot Equivalent Unit
UK: United Kingdom
UNCTAD: United Nations Conference on Trade and Development
USA: United States of America

1. INTRODUCTION

In this chapter, we will describe the background of the study, the purpose and a presentation of problem discussion. The background presents the idea urged by the Swedish Maritime Authority, its need and its way of effectuation. While chapter two is going to cover necessary method and research design, chapter three describes the overview of world and Swedish shipping industry. The time and cost factors in transportation and especially in liner shipping will be examined in the following chapter in order to understand the accessibility concept of SMA better. In chapter five, we will examine the performance evaluation of logistic activities; what kind of systems is available in logistics to measure performance. Finally at the end of chapter we will see is there any applicable system for our precise subject and our findings/suggestions for the sample cities.

1.1. Background

While the world trade is increasing day by day, Sweden and the region around Sweden is going in a parallel way by supporting this global trade by its maritime activities.

Sweden's geographic position and its considerable dependence on foreign trade offer shipping a dominant role in the Swedish transport system. In volume, Swedish cargo transport is dominated by imported oil and traditional export products connected to mining, steel and forest industries. These products are predominantly transported by maritime vessels.

Since the market, from a shipping point of view, fell to all time lows in 2001, freight volumes have increased approximately 15 percent. During 2002 to 2005 freight volumes turned upwards again. The 2006 volume means that this development will continue while being fairly weaker.

The container line is like a bus line or like a ring with stops along the line; however some container lines operates between hub port and destination port. In the Baltic States Region (BSR), container transport is the fastest growing shipping segment. BSR includes almost 25 container ports with at least one call per week by some of the almost 20 operators. There are two reasons serving the growth in container transport in BSR. First factor is the increased market demand for manufactured goods in the new EU-member states and in Russia. Second factor is the growth 'containerization' of bulk- and break-bulk export cargoes. Practices of that process are the increase in the number shipments of pulp, paper and sawn wood in containers from Sweden —west coast of Sweden doesn't belong to BSR— and Finland.

Most of the manufactured or semi-manufactured products are transported in containers. When the container carriers come from Asia, it generally enters at Europe's deep sea ports. If the container continues by sea to this region the transshipment to a feeder vessel is performed, if not road or rail are the main options into Europe. There are multifunctional dry cargo and RORO vessels that containers can be loaded. Even though liner shipping operates in a given route, operators continuously look forward to adjust their services in order to offer competitive prices to transport buyers.¹

¹ Baltic Maritime Outlook 2006 and SMA Annual Report 2006

Figure 1 shows the number of arrivals in North European container ports by focusing transportation to/from Sweden. The figure also refers the frequency of calling ships with blue dots as it mentions the occupancy level of North European Ports.

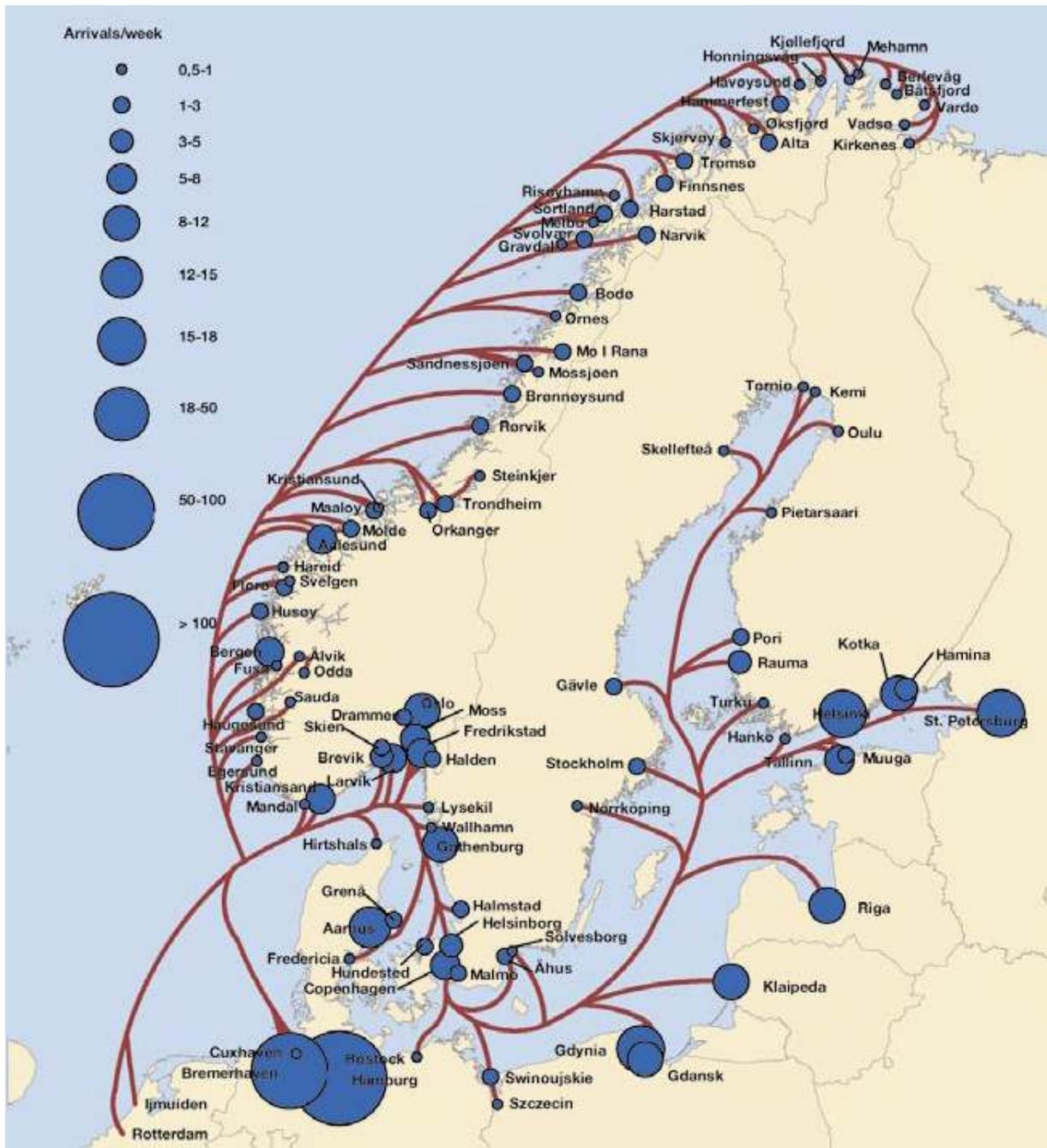


Figure 1: Number of Arrivals in North European Container Ports
Source: Baltic Maritime Outlook 2006, SMA Annual Report 2006

According to the table it is very easy to understand that one of the biggest ports in the area is Hamburg. As number of arrivals of the vessels also shows the occupancy level of a port, Port of Hamburg acts as a main gate way to the continent and it is a busy hub-port which is shown with the biggest blue dot in the figure.

When we focus on Sweden, Port of Malmö and Göteborg is coming front. Port of Göteborg mentions itself as number 65 in the world and number 15 in Europe on the world top 100 ports list (according to tones handled as well as TEU handled) with a vision statement of “Göteborg is the obvious hub for sea transports in northern Europe”.²

While ports are really essential for a maritime trade, on the other hand the main users of these ports which are the container service operators or shortly carriers play a great influential role over every aspect of liner shipping.

According to table 1 which shows number of ships, and TEU capacities of 20 biggest operators in the world, only the sum of Maersk and MSC account for 18.4 % of the total containership capacity of the world. Briefly all those ports mentioned in figure 1 are mainly dominated by leading container service operators such as A. P. Moller Group (Maersk), MSC and P&O Nedlloyd etc... as well as rest of the ports in the world are rather in same dominated position.

Ranking	Operator	Country/territory	No. of ships in 2005	TEU capacity in 2005	TEU capacity in 2004
1	A.P. Moller Group	Denmark	399	1 005 554	900 509
2	MSC	Switzerland	264	713 808	618 025
3	P&O Nedlloyd	UK/Netherlands	165	490 435	426 996
4	Evergreen	Taiwan Province of China	150	450 927	437 618
5	CMA-CGM Group	France	192	426 994	373 191
6	NOL/APL	Singapore	106	322 520	295 321
7	China Shipping	China	108	304 788	236 079
8	COSCO	China	116	299 961	253 007
9	Hanjin/DSR-Senator	Republic of Korea/Germany	77	296 938	284 710
10	NYK	Japan	107	287 137	265 192
Subtotal			1 684	4 599 062	4 090 648
11	OOCL	Hong Kong (China)	68	236 018	216 527
12	CSAV	Chile	88	231 419	190 143
13	MOL	Japan	72	226 105	213 195
14	K Line	Japan	74	219 560	195 750
15	Hapag Lloyd	Germany	57	215 694	186 610
16	Zim	Israel	90	210 407	196 420
17	Hamburg-Sud	Germany	86	191 333	131 713
18	Yang Ming	Taiwan Province of China	68	189 939	168 006
19	CP Ships Group	Canada	76	179 209	196 317
20	Hyundai	Republic of Korea	37	142 257	139 243
Total top 20			2 400	6 641 003	5 924 572
World fleet estimated at 1 July 2005 and 2004			-----	9 355 000	8 835 000

Table 1: Leading 20 Service Operators of Containerships at mid-September 2005 on the Basis of Number of Ships and Total Shipboard Capacity (TEU's)

Source: UNCTAD Secretariat, compiled from Containerization International, November 2005, p.65; Containerization International Yearbook, p.8 and Shipping Statistics and Market Review, October 2005, p.23

² Port of Göteborg, <http://www.portgot.se/>

While all those players (carriers) are competing in the market, all players are not serving with same freighting structures. If we divide the liner freight market as chartering freight of containerships and general freight rates in major routes, freight rates on the three major liner trade routes can be seen at table 2, while we won't go into the details of chartering of containerships issue.

	Trans-Pacific		Europe-Asia		Transatlantic	
	Asia- United States	United States- Asia	Europe- Asia	Asia- Europe	United States- Europe	Europe- United States
2004						
First quarter	1 850	802	733	1 686	778	1 437
Change (%)	-2.2	-1.0	-2.8	1.4	-6.7	-2.2
Second quarter	1 863	819	731	1 738	788	1 425
Change (%)	0.7	2.1	-0.3	3.1	1.3	-0.8
Third quarter	1 946	838	735	1 826	810	1 436
Change (%)	4.6	2.3	0.5	5.1	2.8	0.8
Fourth quarter	1 923	806	769	1 838	829	1 471
Change (%)	-1.1	-3.8	4.6	0.6	2.3	2.4
2005						
First quarter	1 867	800	801	1 795	854	1 514
Change (%)	-2.9	-0.7	-4.2	-2.3	3.0	2.9
Second quarter	1 845	781	821	1 794	872	1 611
Change (%)	-1.2	-2.4	2.5	0	2.1	6.4
Third quarter	1 906	815	815	1 778	918	1 691
Change (%)	3.3	4.3	-0.7	-0.9	5.3	5.0
Fourth quarter	1 878	815	825	1 709	983	1 769
Change (%)	-1.5	0	1.2	-3.9	7.0	4.6
2006						
First quarter	1 836	818	793	1 459	985	1 832
Change (%)	-2.2	0.3	-3.9	-14.6	0.2	3.6

Notes: Information from six of the trades' major liner companies. All rates are all-in, including the inland intermodal portion, if relevant. All rates are average rates of all commodities carried by major carriers. Rates to and from the United States refer to the average for all three coasts. Rates to and from Europe refer to the average for Northern and Mediterranean Europe. Rates to and from Asia refer to the whole of South-East Asia, East Asia and Japan/Republic of Korea.

Table 2: Freight Rates (Market Averages) on the Three Major Liner Trade Routes 2004-2006 (\$ per TEU)

Source: Review of Maritime Transportation 2006, UNCTAD

According to table 2, in late 2005 the freight rate level in the transatlantic route was visibly higher than the year 2004 levels. On the trans-pacific route that commodity activities are the biggest of the three key routes, freight rate trend was unsatisfying at 2005, especially on the foremost part North America—Asia.

1.2 The Problem and Problem Discussion

Container trade volume is increasing in both sea container business and intermodal transportation business in the world. Although there are many ways to evaluate the performance or the efficiency of a port, terminal and ship, there is no solid methodology to measure the yearly trend of door to door trade supplied by liner shipping. This measure ought

to involve a solid indicator system for the yearly prices and time processes of different companies and of different routes connected to Sweden.

On Lloyds 6th Short Sea Shipping Europe 2000 Conference in Duisburg, Chris Welsh, Secretary General of European Shipping Counsel (ESC), made a speech about measuring performance in short sea shipping which showed first awareness and need of such a measurement in November 2000.

In his speech Chris Welsh explained that the Northern Quality Shipping (NQS) encouraged by the Scandinavian countries, Baltic States and northern European nations has continued to help the growth of a feasible short sea shipping industry. The importance of offices, main bodies and information centers was also mentioned in order to increase awareness of the services provided and to sustain fully integrated short sea shipping in the shipper's overall door to door supply chain. Chris Welsh also mentioned about the European Shipping Council (ESC)'s plan, approached by Swedish Maritime Administration (SMA) and Maritime Department of the Ministry of Transport. The plan aims to define Service Performance Indicators (SPI) in the short sea sector, specifically between the Goteborg-Rotterdam links. The speech was continued by talking about the presentation given to the Swedish and Dutch governments, the Swedish and Dutch ship owners' associations and representatives of the ports of Goteborg and Rotterdam to explain how ESC and Freight Transport Association (FTA) had developed the air cargo key performance indicators which can also be established to relevant service performance indicators in short sea trades. After discussion the air cargo Key Performance Indicators (KPI)', ESC and FTA was asked to organize a project to introduce similar SPI's on a short sea service between Goteborg and Rotterdam and with the interest of all parties such a project was agreed to pursue in the future.³

After this conference, Swedish Government nominated Swedish Maritime Authority three years ago to deal with the project. This project has been launched by a reference group led by Mr. Henrik Swahn from SMA and Stefan Back from SwedFreight at that time. They tried to find a Big Mac index of a typical container transport that could be followed over time. That attempt failed mainly because it was, and apparently still is, hard to get facts of prices from operators. They tried to gather information via shippers, but it never got anywhere.

The governmental bodies like SMA are not allowed to gather related data under competition law, so they couldn't move so further away. Difficulty in getting time and price data seems as main restrictive factors for SMA to reach beneficial outcomes for the project.

1.3 Purpose

The purpose of this study is to explore the feasibility of developing a methodology to assess the accessibility of maritime container transportation, visualized by a sample transportation table. For this purpose some sample cities are determined both in Sweden and abroad to figure out the related data gathering process and possibility of developing some time and cost key performance indicators.

³ Lloyds 6th Short Sea Shipping Europe 2000 Conference in Duisburg Measuring Performance in Short Sea Shipping - A Progress Report Chris Welsh, Secretary General, ESC Publications

1.4. Delimitation

We have to limit our subject to containerized trade (TEU based) for the assessment of given destination's table which you can see at Appendix I. The table, in the Appendix I, includes some cities from Sweden as origins and some from abroad as destinations. As a sub-limitation this case table will only cover Sweden originated exports. Additionally, we will only evaluate one of the six aims of SMA which is the accessibility concept and it will be also examined under the concept of cost and time of transport buyers in detail.

The methodology won't cover the parameters affecting to the final price of the transport such as sudden increase in bunker rates, different charging tradition of a port authority or terminal, or an economic crisis. The reasons for these alterations over the price or a time/schedule of a carrier can be another research subject.

The prices are one of most vital and sensitive subjects for transport companies. Especially either liner freight rates or door to door transportation rates are rather confidential. It is not very common for firms to publish their current or former prices but on the other hand plenty of them have these rates in their internal databases for their own sake. But we could find Maersk as an example of internet based price publishers not some more others.

It is also hard to force these international companies to submit their prices regularly to a governmental body, because it is contrary to international and national competition laws either in Sweden or in other European countries. In fact a shipper, who needs the transport service, has not much difficulty in reaching the related freight rates. Additionally most of the shippers have already prior contacts, they know their amount of cargo, their production or export frequency etc, so there is not much struggle of reaching the freight rate or transit time information. So in the actual market there is information symmetry. On the contrary, a continuous and a regular action of trying to reach this information can be costly.

Lack of time and lack of company contact person's willingness to share any kind of information were the main limitations on the questionnaire side of this project. Therefore, this research was more based on secondary research rather than primary research. Moreover, the final framework could have been tested over the theory and other frameworks mentioned in literature review if there were more time, money and sector-specific contacts.

1.5. Related Studies and Research

The European Shippers' Council assists shippers to improve the performance of their transport and logistics supply chains by cooperating with transport providers to support them to standardize their services. In 1998, ESC hold some studies in the air cargo market to define ESC Air Council's key performance indicators and the publication of the ESC code of best practice in the dry bulk shipping sector. Related studies are also planned with regard to short sea shipping sectors. But all these ideas couldn't still be effectuated. As ESC didn't freely publish any of the data or presentation either for shipping industry or for airlines industry, we don't know what or if they have achieved something about indications and measurement systems of cost and/or time.

The main pre-study of the project was lunched by Mr. Henrik Swahn who was working at SMA at that time which resulted with a failure (We have got this information from our

personal interview with Mr. Henrik Swahn but we couldn't reach any official report from Mr. Swahn or from his team.).

Nevertheless there were some related studies like the port performance evaluations, indicators and methods; Vinnova's the North European Maritime Container Feeder Market report, annual reports of SMA, studies of European Shipping Counsel to Define the Key Indicators for Air Transportation (which is unavailable to reach currently), Maritime Economics & Logistics' article about the time factor in Liner Shipping and measures and measurement systems in logistics and transportation rather implemented in the United States of America.

As it is a precisely unique subject to examine we would like to mention there were no directly related study on time and cost of transport buyer in liner shipping or door to door transportation.

2. METHODS AND RESEARCH DESIGN

The aim of this chapter is to give the reader a better understanding of the research process, the structure of written report and description of the way followed during the research. Besides, that part gives an insight for the way of formulation and identification of research questions.

2.1. Research Design

Research design is an important phenomenon for all research types. The importance of research design comes from its ability to build logical sequence of the findings to reach useful conclusions. In a way, the research design is outlining the research by asking practical questions to study, relevant data, data to collect and analysis of the results.⁴

The research is defined in different ways by different people. According to Donald R. Lehmann the research is the gathering, processing and analyzing the related information. That process starts with problem definition and finalizes with a report including the necessary action recommendation part. Zikmund (1999) divides market research types into three categories as: Descriptive Research and Causal Research and Exploratory Research. It will be wise to have a look to short descriptions of the research types, before choosing the suitable method for our project.⁵

Descriptive Research: Descriptive research is also called as statistical research which describes data and characteristics about the phenomenon being studied.

Casual Research: Analytical research techniques focusing critical factors for the subject researched.

Exploratory Research: That research method is problem oriented whose aim is to identify the nature of the problem. Research is conducted for clarification the problem better, followed by determination the best research design, data collection method and selection of the groups. Exploratory research is often dependent on secondary data such as available literature and/or data, or qualitative approaches like informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies.

On the preliminary stage of our research we will try to find the related data of price and timing reflecting to the transport buyer. On the price aspect we have to gather the prices from the freight forwarders or directly from liner agencies. The data gathering process is also rather sensitive because it is one of the main things that can affect the reliability of the project. The number, size, power, location, willingness and truthfulness of the service providers are the factors affecting to the sensitivity of the data gathering process. Especially, in order to get the freight rate data from the companies we will take support from Swedish Maritime Organization which will make our questionnaire official. For this reason, we tried to collect these data by a questionnaire letter using regular mail that will be sending and picking up from Swedish Maritime Authority's office. The data gathering process seems like rather

⁴ Yin, 1994 http://cq-pan.cqu.edu.au/david-jones/Reading/Misc_Research_Approaches/Yin/

⁵ William G. Zikmund, Business Research Methods, 7E

problematic and hard because of unwillingness or work load of the companies but it still feeds the heart of the project in order to reach the solid assessment step. Moreover if we gather adequate data, we hope that the methodology that we are trying to create will show the yearly trend of freight rates and some simple comparisons by some variations. Nevermore, sustaining the yearly continuity of the data gathering process can remain complex and hard.

The other step of the project is to have a general look to the shipping and especially liner shipping industry and afterwards examining existing general measurement systems and indicators in logistics and in transportation.

On the other step, the determinations of indicators are affected by numerous of internal and external factors. Though our primary aim is to develop a methodology to assess the accessibility of containerized trade for different cities from Sweden, the character of shipping or door to door transportation is naturally international. That's why some major destinations are determined for abroad leg by the Swedish Maritime Authority which is better to assess at first sight.

After obtaining the present and past base freight rates collected from companies for our door to door transportation table, first we will try to compare the yearly price and transportation time differences of same companies and other companies for same routes. Afterwards there will be another comparison of price of door to door transportation per kilometer with different routes.

2.2. Data Sources

It is favorable to use as many sources as possible because no single source has advantage over all the others and all are complementary of each other

Due to the broad nature of this research topic secondary research was sufficient to conduct this thesis since there is not wide range of academic information sources regarding this research topic. On the other hand there would also have been time constraints and possible low and unreliable response rates to questionnaires to collect primary data because of the selected companies' unwillingness to disclose their freight rates. Considering all these aspects, it could be best to combine primary data from the market and all the relevant literature review to this topic to reach meaningful and feasible comprehensive framework including all the aspects of the research question.

Primary data were obtained from the questionnaire and interviews with companies and with lecturers of several different universities. Aim of interviews was getting more information about pricing and time concepts to find related key indicators to measure accessibility. Moreover for secondary data library research was chosen for relevant literature from all possible sources and formats, including journal articles, expert contacts, books, theses, and internet.

In this research secondary data is used to answer the research questions rather than using primary data which can be collected by questionnaires and interviews. The main reason why this thesis heavily relied on the secondary data was the lack of time, resources, contacts and experience to conduct a primary research. Both qualitative (information based on attitudes, beliefs and shades of meaning) and quantitative (information collected and expressed using a

numerical measure) data can be available in secondary data. In addition to that, secondary data include both raw materials and published summaries.⁶

2.2.1. The Choice of the Case Determinants for the Questionnaire

On the data gathering phase, we made a market research about the main transportation service providers who has an office in Sweden. Afterwards, we decided to send a questionnaire approved by Swedish Maritime Authority about their basic freight rates and transit times. As the concept of accessibility will be examined only under cost and time factors, the cost of transport buyer refers to price and transit time offered by a carrier. These factors are also discussed deeply under the cost and time chapters. But in order to get a specific price quotation we need to have a specific commodity, with a specific packing type, weight, payment and desired terms so on so forth. Thus, we determined the details of our requested freight quotation as:

*1*20 dc 16580 kg, souvenir, in boxes, CIF prepaid*

for the destinations mentioned in our questionnaire table (See appendix 1 for the questionnaire).

Although containerization brought the standardization and easiness to handling and shipping, there are many kinds of standard containers from 10 foot equivalent to 40 foot equivalent, from dry cargo ISO containers to reefer ISO containers. Every specific cargo must be carried by the most suitable type of container according to the cargo's carriage needs, amount, value, size, type and according to the means of transportation and vehicle.

We have selected souvenir in boxes as a representative commodity which is easy to handle, is not dangerous cargo, and doesn't need any other extra treatment that can make extra cost. 20' (TEU) container is one of the most common and frequently used container types in today's transportation and our good is suitable to be carried by 20' with its dimensions and weight.

Our sample freight and time table in the questionnaire is prepared only for export shipments from Sweden and in order to get reliable and more convenient prices from the transport providers that we have asked, the Inco Term "Cost insurance and Freight" (CIF) and the payment method "prepaid" is nominated. CIF and "Free on Board" (FOB) terms are also one of the most common Inco terms used in transactions. So we had to match the payment place and office where we get the transportation prices. Even though the logistics service that we were going to take remains same, if we had been taking the Swedish export prices from other agencies, the price was going to change because of the different profit implementations of different offices of same companies.

If we come to the reason of why those cities selected in the case cities table, the answer is obvious. The cities on the table are mainly decided by SMA. Nevertheless if it is needed to describe the reason of SMA behind the selection; Sundsvall is chosen as a representative of North Sweden and Malmö is chosen as a representative of south part of the country. Other cities represent the door to door freights with their inland position in Sweden. On the outbound leg of the shipments, Boston shows the heavy freighting between USA and Sweden on west leg, Shanghai represents the Far East leg shipments and St. Petersburg reflects the

⁶ Saunders, et al. 2003, p. 188, 189

East European leg. Additionally each abroad destination of these export routes have a deep hinterland covering their regions, and each can imply as one of the busiest ports in the world with their strong trade supply volumes except Frankfurt. Frankfurt which is an inland point can be a door to door transportation route sample which represents the trade connections between Sweden and Continent.

2.2.2. The Case Questionnaire

We sent our questionnaire letter on the name of SMA to 23 transport related companies including freight forwarders, liner agencies and logistics service providers who has offices mainly in Gothenburg both by regular post and email. The questionnaire involves the aim of our research and by this way aim of our questionnaire, the benefits of the study to themselves, questions about the chosen routes' freight rates, lead times and distances.

Instead of gathering these data and comparing them, the auxiliary purpose was to see how many companies were responsive and cooperative, try to find out is it the best way of gathering valid and reliable data i.e. annually from the companies, to see the coverage of the data and companies' such kind of data feeding ability.

The content of the questionnaire is prepared in corporation with a project manager in SMA and send under the control of the project manager

It was going to be better to have a high number for the coverage of period investigated in the case such as a 10 years annual data or a 3 years quarterly feeded data but in reality dealing with big and busy companies is very hard especially on an absolutely sensitive subject. Thus, we decided to limit the former data scope with 3 years annual data for the questionnaire.

2.3. Validity and Reliability Issues

According to Yin (1994), Janesick (1998) and Donmoyer (cited in Janesick, 1998) serious errors can be occurred while statistical generalization as a method of generalizing the results of the case. The reason of the error grows out of the fact that cases are not sampling units and should not be chosen for this reason. Under these it is better to choose 'analytic generalization' in which a previously developed theory or observation is used as a pattern to compare observed results of the case study.

Research strategy is a general guideline of how a researcher will answer the research questions set at the beginning of the study.⁷

In this thesis, literature review was employed as well as research strategies including: survey, experiment, case study and so on. Due to the nature of the topic, time constraints and possible low and unreliable response rates to questionnaires was considered as negativity for this thesis.

In our research, the sample table case basically includes prices and lead times. Though we have contacted with the transport provider companies directly with this sample table questionnaire, those companies responses about the freight rates and times can not be hundred percent accurate. Companies' response times, their willingness to share true information, their

⁷ Saunders, et al. 2003, p. 90.

lack of ability to reach current and/or former data, giving consciously round figures are some factors that can affect the validity and reliability of data that we tried to gather.

3. THE SHIPPING INDUSTRY AND THE SWEDISH MARITIME AUTHORITY

In this chapter while we are examining the global shipping industry, liner shipping industry and the Swedish shipping industry, at the same time we will mention the Swedish Maritime authority and its role.

3.1. Overview of Global Shipping Industry

Today, around 90 % of the world trade is carried by international shipping industry. With no shipping, the modern world would suffer a lot while importing and exporting goods. Shipping industry is growing gradually which helps to decrease freight costs while increasing efficiency of shipping. With the help of increased industrialization and economic liberalization further growth is expected in shipping industry. Development in technology also assists shipping by sustaining fast method of transportation.

Around 50.000 merchant ships which are registered in over around 150 nations are transporting every kind of cargo. Volume of the world seaborne trade is estimated generally in terms of tones or ton-miles. Estimation in terms of ton-miles is more common which is calculated by multiplying tones carried with the distance traveled. For example, from the graphic below one can see that, for the year 2004, 6.7 thousand million tones were carried over distance 4 million miles, which makes over 27 thousand billion ton-miles of total trade.



Figure 2: World Seaborne Trade 1994-2005

Source: Fearnley's Review 2004

As it can be seen on the graph above the seaborne trade, like all other industries, was negatively affected during the worldwide economic recession of the early 1980s. A result of recession was seen as decrease in the yearly transported cargo carried by merchant ships. Also, the growth of seaborne trade was diminished by the Asian financial crisis of the late 1990s. Otherwise shipping industry is in growth trend. With the aid of economic expansion of China and India, the growth of shipping industry is expected to continue.⁸

3.1.1. Transport Buyers and Other Actors in Shipping

Transport buyer is the customer of one of the service providers. It can be the shipper or the consignee or a representative of the cargo/interest owner.

The shipping industry has traditionally been replete with intermediaries performing various important value-add and critical steps to complete the transportation cycle. Traditional intermediaries in the shipping industry have included namely as;

- shipping agency,
- freight forwarders,
- customs brokers,
- ocean carriers,
- non-vessel operating common carriers (NVOCC's),
- third party logistics service providers (3PL's) and many other specialists.

The most important ones for our research are for sure shipping agencies, freight forwarders, logistics service providers and NVOCC's which is rather more active in the USA.

Shipping Agencies are companies that mainly work for the owner of the ship and their responsibility is limited by the owner. They translate information about the port or ports and give report to the owner about those ports and protect rights of the ship-owner or the captain against the law. These agencies response their services whether by the vessel or by the commodity that they organize to load on the vessel. They also give compulsory service on behalf of the ship-owner or the captain and inform the ship-owner for the strike & lockout. Preparation of a report about the tariffs that has to be applied by the port authority and giving information about costs at port or what else, dealing with the vessel operation at the port and vessel controls on arrival and departure, giving Estimated Time of Arrival and Estimated Time of Departure (ETA – ETD) and just like information to customers are also under the fundamental responsibilities of shipping agencies.

Freight Forwarders (FF) are traditionally considered one of the components of international shipping. In essence, they make all arrangements with the ocean carriers. Freight forwarders aid international shipping by processing the export/import documentation for international transactions. The scope of the freight forwarder industry is continually expanding and adding multiple services to meet the needs of their customers. For instance an FF offer a fixed price without the obligation to give account to the customer for his actual cost, he will be come a non –vessel operating carrier and shall be subjected to the applicable law relating to carriage of goods.

⁸ Review Of Maritime Transport, 2004, UNCTAD
<http://www.marisec.org/shippingfacts/worldtrade/value.php>

Logistics Providers try to put the entire picture together in a "one call - do all" concept. All the services performed by the intermediaries are covered under the umbrella of the logistics provider, with the added benefit of consolidated logistics information. Although there is always discussion whether consolidating all your logistics functions in one source is a smart business decision, the concept alone of the logistics provider is intriguing.

Companies outsource their supporting activities to a third party logistics service provider, and finally they act much freer in their operations.

NVOCC's (Non-vessel Operating Common Carriers) are common carriers that does not operate the vessels by which the ocean transportation is provided, and is a shipper in its relationship with an ocean carrier but which issues bills of lading in name to shipper under its solicitation to whom it directly assumes the liabilities and responsibilities of a common carrier. Ocean carriers and consolidators work together in strong partnerships to benefit the operation of each organization. In many countries these intermediaries are called ocean consolidators and many freight forwarders perform both air and ocean consolidation.⁹

3.1.2. International Container Transport

Approximately 2.04 billion tons of dry cargo is being transported along the liner trade routes. Roll on/Roll off (RORO), refer and cars coexist with general cargo services in order to support container trades. Though most of the routes are at maturity level, growth rate with couple of routes reached to two digit levels, with total estimated around 100 million TEU. Container cargo shipments differ from the other dry bulk cargoes in increased use of transshipment to arrive at destination. Routes for containerized cargo are east-west (Trans-Pacific, Europe-Far East and Transatlantic), north-south and regional routes.

Among the routes the largest flow is between east-west, the Trans-Pacific, with the total estimated to be close to 18.1 million TEU's in 2005. Asia to North America container flow is the important leg with around 13.8 million TEU's, while in the opposite westbound direction the flow was around 4.3 million TEU's. Because of the imbalance of container flow, some problems with repositioning the empty containers remained occur for the carriers. According to the 2005 reports 15.7 million TEU's were carried between Asia-Europe routes. There is also a different between flows in the westward direction derives in Asia, which is around 10 TEU's, and those flows in eastward direction, estimated at 5.7 million TEU's. Though flow difference was less pronounced than the present across the Pacific. On the east-west transatlantic route the container flow was estimated around 5.2 million TEU's. Since, the dominant leg from Europe to North America reached 3.8 billion TEU's while the opposite direction is around 1.8 million TEU's, the flow imbalance is less severe. Total traffic flow on these three east-west routes have reached around 40.000 TEU's, with repositioning the empty containers is still an important issue.

The main routes in north-south direction are main production and consumption centers of Europe, Far East and North America and between the links in cities in developing countries. The estimated containerized cargo carried north-south route is around 17 million TEU's. Between Europe and West Africa container flow is estimated 0.8 million TEU's while that flow is 0.7 million TEU's between Europe and Oceania. Imbalance of container flow between southward and northward directions is easily recognizable. Since the container flow between

⁹ Dokuz Eylül University, School of Maritime Business and Management 2004-2005, Sadun Zeki Özkaner, Course Presentations

Europe and Central and South America is around 2.8 million TEU's which is almost four times larger than southward direction with 0.8 million TEU's. Again imbalance of flow between North America and Central and South America exists, since that flow is about 4.0 million TEU's while southward direction flow is about 1.5 million TEU's. On the other hand container flow is rather balanced between Asia and Oceania which is estimated around 1.6 million TEU's. In 2005, for the regional route 2 from North-East Asia to South-East Asia container flow is calculated about 7.2 million TEU's.

In the mid of 2005 the Panama Canal, the major gate way for liner and bulk shipping, started to raise charges declared previous year. With the current infrastructure, The Canal is operating with 90% capacity but number of technical projects and studies is introduced to expand the existing infrastructure. The projects include a third set of locks able to handle 12,000 TEU capacity containerships that will cost \$5.25 billion for the completion in 2014.¹⁰

3.2. The Shipping Industry in Sweden

Sweden's geographic position and its considerable dependence on foreign trade give shipping a dominant role in the Swedish transport system. In volume, Swedish cargo transport is dominated by imported oil and traditional export products connected to mining, steel and forest industries. These products are predominantly transported by maritime vessels.

Since the market, from a shipping point of view, fell to all time lows in 2001, freight volumes have increased approximately 15 percent. During 2002 to 2005 freight volumes turned upwards again. The 2006 volume means that this development will continue while being fairly weaker.

The container line is like a bus line or like a ring with stops along the line; however some container lines operates between hub port and destination port. In the Baltic States Region (BSR), container transport is the fastest growing shipping segment .BSR includes almost 50 container ports with at least one call per week by some of the almost 20 operators. There are two reasons serving the growth in container transport in BSR. First factor is the increased market demand for manufactured goods in the new European Union member states and in Russia. Second factor is the growth 'containerization' of bulk- and break-bulk export cargoes. Practices of that process are the increase in the number shipments of pulp, paper and sawn wood in containers from Sweden and Finland.

Most of the manufactured or semi-manufactured products are transported in containers. When the container carriers come from Asia, it generally enters at Europe's deep sea ports. If the container continues by sea to this region the transshipment to a feeder vessel is performed, if not road or rail are the main options into Europe. There are multifunctional dry cargo and RORO vessels that containers can be loaded. Even though liner shipping operates in a given route, operators continuously look forward to adjust their services in order to offer competitive prices to transport buyers.¹¹

¹⁰ Review Of Maritime Transport, 2006, UNCTAD

¹¹ The Competitiveness of the Swedish Shipping Industry, Annual Report 2000, SMA

3.3. The Shipping Infrastructure in Sweden

Ports

Ports are used to be called as a place for receiving ships and transferring cargo, but nowadays ports are rather as terminals where people, goods and modes of transport get together and where, solutions to logistical problems are developed. Ports provide assets and resources not only to the ships but also to the railway cars, lorries and automobiles etc. At that point ports are important link in production chain. Since the missing parts delays plant operations, time and reliability are very critical when raw materials and other materials are loaded, unloaded, stored or shipped.

Companies operated at ports are called as ‘port companies’, who serve transport and logistics industry associated with both land and sea. Port companies have a broad network of stakeholders, even more stakeholders than most of the companies. For both the Swedish and international transport industries, the port companies are significant actors and hubs. There are connections between ports in different countries which allow efficient port operations. Besides ports and port companies are parts of intermodal transportation which includes reloading between vessels and trucks, vessels and railways, and also between vessels and vessels. Since intermodal transport is cost efficient and environmentally friendly port’s good connections to the land also important as well as to sea.

Swedish Ports

Most of Swedish ports are limited liability companies with integrated operations who are in charge of development of the port infrastructure and providing cargo handling services. Some of the port companies own infrastructure themselves while others rent the land from the owner which is generally the municipality. Cost of the infrastructure is part of the service price charged from customers and users.

- Sweden has 52 ports used for commercial traffic, which represents 80% of all traffic (measured in tones) at Swedish ports.
- The remaining traffic is realized via approximately 56 of industrial ports. The largest of industrial ports is Brofjorden, on the west coast of Sweden, owned by the oil company Preem.¹²

Role of Swedish Ports in Foreign Trade

Swedish foreign trade has been increasing year by year. Since ports are gateways for Sweden to reach rest of the world, the efficiency of Swedish ports become more important.

- Approximately % 85 of all goods imported to or exported from Sweden was transported through ports. The remaining percentages of imports and exports were transported by air or by truck/train across the Norwegian-Swedish border or the Finnish-Swedish border.

¹² Ports of Sweden on Port Infrastructure, European Sea Ports Organization and Baltic Maritime Outlook 2006

- Almost 96000 calls were taken at Swedish ports by vessels in 2006, which equals one call every seven minutes
- Volume of goods at Swedish ports is increasing
- European countries are Sweden's biggest trade market with 73, 4 % export rate and 82, 8 % import rate. Then comes America (13% export and 5, 9% import) and Asia (10% export and 10, 7% import).¹³
- Engineering goods (i.e. car, machinery and electronic products) accounts for about half of Swedish imports and exports. The remaining Swedish imports and exports is divided between forest products (mainly paper) —very little amount of forest products are importing to Sweden—, chemical products (pharmaceutical, plastic products), mineral goods (i.e. ore, iron, steel), energy goods (oil products) and other goods (clothes, furniture etc.)

The largest types of goods for each category (figures for 2004) ¹²

Interest Groups to Ports

- Stake holders
- Neighboring customers, in all types of trade and industry, both Swedish and foreign
- Transport industry consisting of haulers, railway companies, shipping lines, forwarding agents, agents and brokers
- Shipping related companies and authorities (sea rescue, pilot authority, border control, ice breakers etc.)
- Politicians are affective on port activities to some extend
- Municipalities, generally owners of the port have a high level of control
- The Swedish Maritime Administration, as a regulator of system fees for inspections and shipping lanes as well as EU and international maritime organization.
- By tradition trade unions have strong power on port authority and essential interest group
- General public can also be affected during their daily lives.

In Sweden, local governments are responsible to finance the general port infrastructure and take decisions regarding port investments. Government is only responsible to construct road and rail connections to the port.

The ports decide about the needed investments and also in charge of finding most favorable financing. If main infrastructure investments are concerned, municipalities generally act as a bank and finance the infrastructure investments. Nevertheless, if the port is capable of finding loan in open market under better circumstances, it is free to do so.¹⁴

¹³ Statistics Sweden, http://www.scb.se/default_2154.asp

¹⁴ Ports of Sweden on Port Infrastructure, European Sea Ports Organization and Baltic Maritime Outlook 2006

The port can be operated by integrated port company which establishes its own yearly accounts or operator can be an external private company which will have its own annual accounts as well. The port is generally part of municipalities but it has its own financial records. In the same manner other privately owned operating companies in the port also keep their own accounts. Sometimes it is difficult to assign accounts to each port if private companies operate more than one port.

Depreciation is often calculated on historical cost based. In addition to that some ports use revaluation, writing of or writing down assets but it is not common.

The rate of return can vary company to company. Dividend payments are realized parallel with Swedish Company Act.

If the port authority is public administration it doesn't pay the company taxes, otherwise the taxation is according to taxation principles in the Swedish Company Act.

The Swedish Maritime authority finances the accessibility to and from the port area through the fees it collects from the users. Within the port, the municipality or the port company is in charge of the maritime access. Sometimes the port company also pays some part of maritime access. For instance, for improvement of entry channels, Port of Gothenburg finances one third of the investment while the rest are paid by Central Government. Concerning the investments to movable assets, the port, company or stevedoring companies are generally in charge.

Charges:

State Dues

Fairway services outside the port area and all the pilotage services are in Swedish National Maritime Administration's responsibility. The fairway infrastructure costs and the services costs such as icebreaking and pilotage are financed by charges on users. The charges can be separated as fairways dues and pilotage dues. Fairway dues consist of two-part fee.

One part depends on the size of the ship, computed on the basis of gross tonnage, and the other part is based on the volume/weight of the cargo being transported by the ship.

Environmental factors are also effective while deciding gross tonnage due. Nitrogen oxides and sulphur rates are taken into consideration in the cases of rebate, for instance if the level of emitted nitrogen oxides is between 12 and 2 g/kWh the dues will be discounted. Considering the fee based on volume of the cargo being loaded or unloaded, there is not much difference among the ports but value of the goods can change the fees being charged.

The pilotage dues depend on the size of the ship and distance piloted. The costs for icebreaking are collected by all ports through the fairway dues.

Port Dues:

Generally in the case of integrated port companies, the customers pay dues as the commercial agreement requires that cover infrastructure cost and services offered by the port company. Besides cargo handling, port companies may offer expanded business services like storage,

forwarding, and clearance. Most port companies are open to negotiate about the prices and about 20 of them offer discounts in their due rates based on environmental measures concerning nitrogen oxides and sulphur reductions. Swedish companies act requires port companies to give an annual dividend to the owner, who is generally the municipality. Although port authorities are part of the municipality, they have separate economic units with responsibility their budgets.¹⁵

3.4. The Swedish Maritime Administration

The Swedish Maritime Administration (SMA) is a government organization whose tasks are defined in the Government's instructions. Transport policy objectives are supposed to be accomplished by SMA in a cost affective way. The revenue of SMA comes from the fees charged from merchant ships, thus SMA is referred as a public service company. The main objective for transport policy is to make sure publicly efficient, long term sustainable transport for both individuals and business all over the country.

3.4.1. Goals of SMA

To design *an accessible transport system* that will satisfy necessary transport requirements of individuals as well as the needs of business and industry.

To sustain *high transport quality* that can be beneficial for individuals, business and industry.

Safe shipping that will minimize fatalities or serious injuries.

To create a *favorable environment* that will allow efficient maritime transport system operations and to maintain a healthy living environment for everybody while promoting natural resources efficiently.

To provide an environment that will narrow the differences in various regions in terms of transport system contribution and to sustain *positive regional development*.

To sustain *gender equal transport system* that offers same opportunities to women and man. Chance to affect creation, configuration and administration of the maritime transport system must be same for women and men.¹⁶

Though Swedish Maritime Administration's *primary tasks include responsibility for providing infrastructural services in the form of safe and accessible fairways to meet the needs of shipping*, we merely will try to examine the accessibility goal of SMA on a business point of view, not on a technical point of view.

3.4.2. Accessibility and SMA's Approach to Accessibility

Accessible transport system includes the following features:

¹⁵ Ports of Sweden on Port Infrastructure, European Sea Ports Organization and Baltic Maritime Outlook 2006

¹⁶ Swedish Maritime Administration http://www.sjofartsverket.se/pages/1051/Om_Sjofartsverket_2006.pdf

- ❖ various transport solutions for different types of transport demand
- ❖ frequency of transport service
- ❖ transport chain costs
- ❖ time spent in transport chains

Accessibility is an important characteristic of transport options or of actual demand in the transport market. Players of others transport services together with maritime sector players create the assortment of transport services offered by the market.¹⁷

Finding indicators about accessibility is important to have an opinion about maritime development and to clarify the policy goals of accessibility, transport quality and regional development.

In order to assemble a basis for evaluating developments SMA cooperate with other players in the sector. Aim of that collaboration is to gradually develop and improve its sector reporting.

¹⁷ Swedish Maritime Administration, http://www.sjofartsverket.se/templates/SFVXPage_5372.aspx

4. EVALUATION OF TIME AND COST MEASURES IN TRANSPORTATION

There is a need of understanding the overall and some detailed perspective of time and cost concepts and measures in transportation because of being two major sub-items of the accessibility concept that SMA already defined. Thus, in this chapter we will mainly try to assess general time and cost factors firstly in transportation and afterwards they will be examined under liner shipping subject as the research is limited by maritime container shipping.

4.1. Introduction

In economic and business sense, price can be described as giving numerical monetary value to good, service or asset. Price concept is important for resource allocation, which is also called as price theory, as well as for developing marketing plan.

The term cost is referred as the cost of transport buyer in our research so it is also the price given by the service provider. Therefore in order to figure it out we have to analyze and understand the general price concept and the pricing of service providers.

But why the freight price or the cost of transport buyer and time concept is our prior research subject among other factors for the transport buyer?

According to the survey held by the Supply Chains Systems Laboratory in Texas A&M University, the cost factor was ranked for the most important factor and on time-delivery ranked second prior which is an indicator of time concept while choosing the transport provider. In figure 3, the results of the survey can be better visualized. In an environment of raising the costs of fuel prices, there is no doubt that cost is important. Results of the survey reveals that damage rate, pick-up times, geographic coverage, carrier flexibility, shipment tracking, invoice processing, carrier financial condition, and carrier technical capabilities are the other important factors chosen by transport buyers.¹⁸

¹⁸ Transportation Benchmarking Survey, <http://supplychain.tamu.edu>

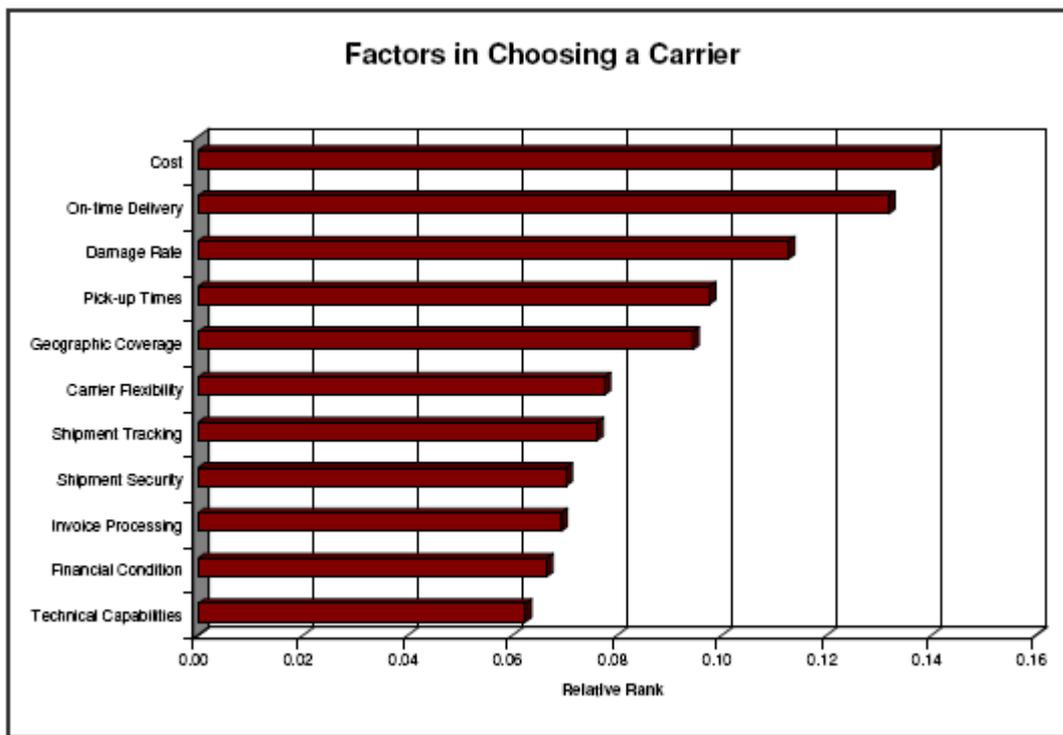


Figure 3: Factors in Choosing a Carrier

Source: Transportation Benchmarking Survey, <http://supplychain.tamu.edu>

Except figure 3 which shows the cost and time as the important factors according to transport buyers, also SMA wants focus on the dimensions of the accessibility in parallel with cost and time subjects of transport buyer. SMA thinks that some aspects can have effects on time and costs. For example alternative transport options can be considered as a mean to achieve low transport costs and cutting transport time. A way to reduce transport time for goods in the transport chain as a whole can be offering frequent service.¹⁹

In a basic sense, we would like to focus on transit time under the concept of transport time which can be described as the number of sailing days on a port to port basis in a maritime transportation. If that definition is broadened, then the transit time is the total time on door to door basis so consist of dwell times at terminals and time needed for pre- and end-haul to the port of loading and from the port of discharge. Since focus of the paper is on the maritime segment port to port definition will be used.

Order of ports calls are influenced by many commercial and operational determinants, comprising the distribution of container origins and destinations over the hinterland, the cargo generating effect of the port (outgoing cargo), the nautical access, the berth allocation profile of a port, etc...

¹⁹ Swedish Maritime Administration, http://www.sjofartsverket.se/templates/SFVXPage_5372.aspx

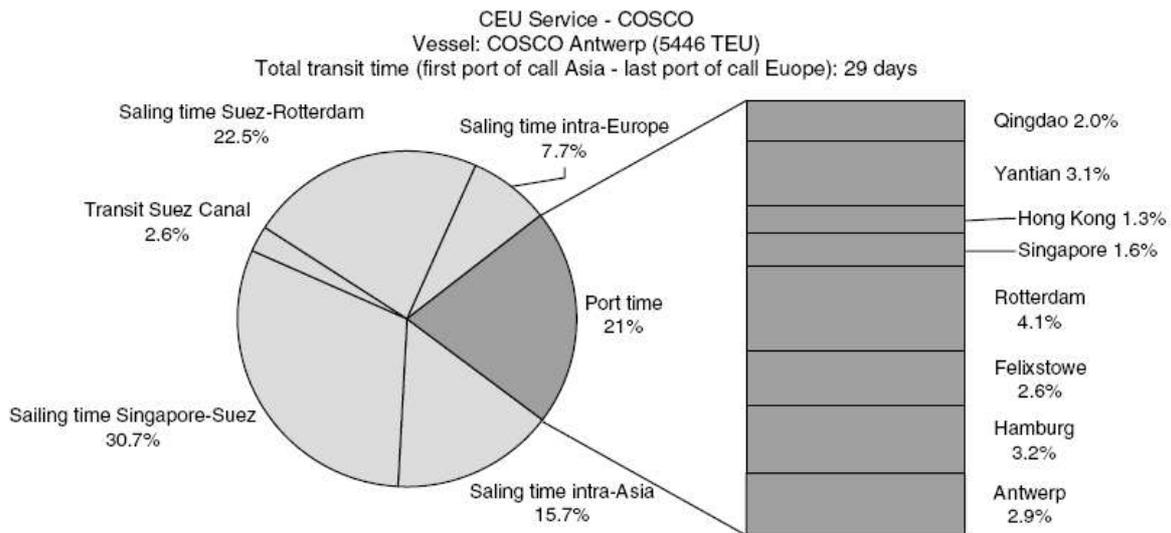


Figure 4: Decomposition of the Scheduled Transit Time for the CEU Service of COSCO
Source: Based on data of COSCO Lines

The position of a port in the port calling order causes the huge variations in transit times. Shipping lines, terminal operators and also shippers are well aware of these variations. Many shipping lines offers several shipping options in order to maximize customer service level, varying from a lowest price – lowest transit time option to fast transit times at a higher door-to-door price (i.e. higher price mostly caused by fast inland transit).²⁰

4.2. Pricing and Price Concept in Transportation

As it is already mentioned what price concept mainly refers in transportation in the introduction part, we will talk more about pricing in liner shipping after examining general pricing decisions in transportation on this part of the study.

For many years tariffs were the most decisive factor to set the price for carriers. Because of the economic regulations, differentiating service or pricing strategy were difficult for carriers. Nowadays, differentiating tactics are more important for carriers in pricing decisions. Unfortunately, however the effects of tariff in pricing are still visible in price setting. This way of thinking is taking cost concept into consideration rather than marketing mix, so while most of the carries know about the cost they don't have in-dept knowledge about how to set the price.²¹

4.2.1. Factors Affecting Pricing Decisions

Carriers' pricing decisions are mainly affected by the incentives from the business environment which includes many constituencies such as customers (market), government, other channel members and competition.

²⁰ The Time Factor in Liner Shipping Services, Institute of Transport and Maritime Management Antwerp, Theo E Notteboom, Institute of Transport and Maritime Management Antwerp, 2000

²¹ Management of Transportation, Bardi, Coyle, Novack, P291,292,293,297

While discussing the market's role to determine the price, value of service pricing is important. For instance a profit-maximizing oriented carrier will set the price at a level that will maximize its return. The price elasticity concept also plays an important role in the market's impact on the carrier prices, which implies that customers' reaction to the changes in the prices, are not the same. While a customer group may be price sensitive the other customer group may not be. In that manner one can say that customers also have a significant impact on carrier prices. The government may affect carrier prices through the transportation regulations or public policies directly or indirectly. Channel members include the other carriers the same mode and in different modes are decisive in price setting. Lastly competitors' price changes should also be taken into consideration for a carrier in order not to lose market shares.²²

4.2.2. Major Pricing Decisions

Companies involved in delivering a product or service face major pricing decisions. That decision can vary from a simple process to the complex one. Though, that process can be grouped into three categories. Firstly, if the service is new which means there are no precedent service supplier the pricing decision can be difficult because predicting the elasticity of the market is difficult. One can set a higher price which will encourage new comers to enter the market with a lower price. On the other hand in the case of setting a lower price may not allow to profit maximization. Second, price modification over time is necessary for the carrier. Because the changes in market, operating changes and service changes should also be followed by the price changes to stay profitable and competitive. Thirdly, if a company is a price leader, it can take initiative to change the price, if not, and then a company can follow the price leader in the case of price setting.²²

4.2.3 Pricing in Liner Shipping

In liner shipping the price discrimination of the services is also very common. According to one of our interviews with the Nuri Kudug, district manager of Arkas Ukraina Co. which is a liner agency representing East Mediterranean Express Service Line (EMES), in Black Sea Region and located in Odessa, Ukraine; service providers are applying usually three kind of pricing system a bit different than product markets.²³

First kind of prices is regular prices decided for normal conditions such as for one standard TEU, for the customer who will work with the service provider for the first time and maybe the last time.

If we call this price as a basic price, the second kind of price will be the contracted price for the customers who decided to work with a nominated service provider for a given period of time with a certain amount of container feeds negotiated on a written contract. Of course, because there is a written proof that the customer will feed the provider, a natural trust of the provider appears and the price decreases to a noteworthy level according to the contract.

²² Management of Transportation, Bardi, Coyle, Novack, P291,292,293,297

²³ Arkas Holding, http://www.arkas.com.tr/pages/arkas_news/mart_2003/haber3.html

The third form is an intermediate price between the contracted price and basic price. It is an intermediate price because the service provider knows its customer for some time and the customer is feeding the line on a satisfactory level although they don't have a written price or feeding contract. In order to have this kind of price, the promise and past trustworthiness of the customer is essential.

As price of any kind of freight is highly variable according to the origin and destination, route, risks covered, economical situation of the globe and legs and/or transit lands of the trade except contracts, we will use basic prices for our project.

Naturally under the free market economy, even from company to company the base price of the freight will be different for a certain route, amount, condition, etc...

Additionally the liner conferences are very dominant on pricing of freight rates. Every member of a unique conference must obey the rules of pricing under the conditions of agreement.

It is told even at 1909's in Royal Commission on Shipping Rings, UK, that "Maritime conferences (which refers to liner conferences on the previous paragraph) finds their origins in the development of colonial English trade... they are an undesirable but unavoidable consequence of Liner shipping"

Pricing System of Containerized Maritime Freight according to Pierre Cariou:

Freight of All Kind (FAK): Price is according to the size (20/40/45 feet) / kind of container (dry, liquid, reefer...)

Pricing system - Extra cost/rebates

- Currency Adjustment Factor (CAF)
- Bunker Adjustment Factor (BAF)
- Extra length (> 12 m.) and extra weight (> 5 tons)
- Special equipment (own container or not)
- Port cost
- Rebates (differed or fidelity)²⁴

4.3. Time Concept in Transportation

In this part we will mainly look at transit time and its reliability both in general transportation and specifically in liner shipping. It is also considered that delays and scheduling of liner shipping services have a significant importance which must be examined in details.

The total-cost implication says that not only the direct transportation cost incurred but also the indirect cost associated with the service provided should be taken into consideration in carrier selection process. In that manner transit time and reliability of transit time, which affect both the shipper and receiver inventory and stock-out costs, are important. To be more precise the transit time affect the level of inventory held and so the inventory carrying costs. As the transit time increase the inventory levels and inventory carrying cost increase. Consequently

²⁴ Co-operation agreements in Liner Shipping, Pierre Cariou, University of Nantes, Genoa 2003
<http://bonjorn.sc-eco.univ-nantes.fr/~pcariou/Publi/Genoacourse20%5E03.ppt>

using a carrier with a longer transit time bears higher inventory carrying costs. Similarly since the reliability of the transit time impacts the level of the safety stock. Unreliable transit times causes the buyer keeps more inventories to guard against stock-out conditions. Therefore using a carrier with a reliable transit time provides carriers with a marketplace advantage.²⁵

4.3.1. The Time Factor in Liner Shipping Services

Invention and development of container shipping accelerated the globalization of the world economy and changed worldwide manufacturing as well as distribution process significantly. With the aid of easier access to exchange goods, new global markets for export and import emerged which led to changes in the way goods are transported. Containerization facilitated reaching further international markets with no sacrifice to the quality of the distribution and without big price changes in freight costs. Considering the manufacturing process, containerization helped to apply 'just in time' (JIT) production by providing improved schedule trustworthiness, low costs, high security and shorter transport times. Container shipping lines also aim at the same targets. Since the increasing complexity of the expanding global transport networks dealing with time and operating liner services is not an easy job. The schedule reliability is very fragile since many factors such as port congestion can upset schedules. Since time is money any delays will cause losing money.

First part talks about design parameters in liner service design and service patterns provided by carriers while carriers' aim is to satisfy customer needs in terms of transit time, frequency and price.

Second part of the study clarifies transit times and schedule reliability while observing sources of delays. Moreover ways to increase schedule reliability are discussed. In order to have a better understanding the concepts developed and issues discussed will be applied to operations on the East Asia-Europe trade, particularly between ports in China, Japan and Korea and the load centers in the Hamburg–Le Havre range in northern Europe.

4.3.2. Designing a Liner Service Schedule

According to Fagerholt,²⁶ schedule design is the most prevalent strategic planning problem for shipping lines. Market to be served is mainly taken into consideration while designing the liner service. Service planners consider three key inter-related decisions about the schedule of the liner service:

The service frequency: At least weekly service from the carriers is expected by the shippers. There is a trade-off between frequency and volume. If smaller capacities are chosen more frequent service is required which will satisfy shippers' lower transit time demand. On the other hand if larger units are chosen operators will not benefit from economies of vessel size.

Fleet size, vessel size and fleet mix: While the optimal vessel size is chosen cargo availability, shippers' desire for transit time is among important factors. When the distance increases economies of vessel size get more important, thus biggest vessels are preferred for long routes. The fleet mix and fleet size are also important in liner service schedule decisions.

²⁵ Management of Transportation, Bardi, Coyle, Novack, P412,413

²⁶ Fagerholt, K. 2004: Designing optimal routes in a liner shipping problem. *Maritime Policy and Management* 31: 259–268.

There should be sufficient vessels to assure the desired frequency. If the size differences among the vessel in the same schedule increase, operational heterogeneity also increases. Shipping lines try hard to create a well-balanced fleet mix within the individual loop. However that is not an easy task to perform, since there are operational and financial barriers in increment of vessel size. As a result fleet mix can not be homogeneous. Raise vessel size on a specific route can take years and requires huge investment.

The number of port calls: If the number of port visited is limited, round voyage time will be shortened and the number of round trips during the year will increase. Limited port calls also require less number of vessels in that specific liner service. Nevertheless, catchment area will decrease because of less accessibility to ports. While adding port calls additional revenue gained and the additional cost endured should be evaluated critically.

While the carriers design the networks to offer, they should also pay attention to the needs of customers in terms of frequency, direct accessibility and transit times. Optimal system may give the network planners an idea about the lowest cost for the entire network being achieved by indirect routing using hubs and the combination of flows. However, the carriers' efficient network may be insufficient to satisfy shippers' needs. Shippers may be unwilling to use indirect routes.

4.3.3. Transit Time, Transit Time Reliability and Schedule Reliability

The container transport is based on time-tight schedules. Short transit time and high degree of reliability is aimed while designing liner services. For shipping lines being stick to the timings pronounced in the official (published) schedules, is a part of flawless service concept that they want to achieve. Delays reduce the reliability of the liner service as well as cause logistics costs for customers as a result of as additional inventory costs and in some cases additional production costs. For instance production may stop because of a late delivery of materials. Delays have some costs for shipping lines also, like cost of rescheduling of vessels or unproductive vessel time.

Comparative importance of the quality dimensions may vary depending on the market segment. For example if the shipping lines operate in a mature market which not allow differentiation or shorter transit times, low number of late arrivals may be a crucial competitive advantage. In other situation being first liner service with a new liner service design concept, transit times as such may be relatively more important than the number of late arrivals.

A schedule tells about the declared timing of round voyage of a specific ship. A delay doesn't always mean low schedule reliability. A carrier may be behind the schedule because of the delays of other vessels within a specific ring, however since the customer just consider the result carrier doesn't succeed in customer perspective. Customers expect from carriers to take precaution to rely on the declared timing such as increasing vessel speed on the main haul in order to avoid delays. Likewise, transit time reliability is not the same as the schedule reliability. Delivery of a container to the indicated port can be timely, while schedule reliability of the vessel is poor. Example of that situation can be a cargo transfer from a vessel to another vessel in order to transport the cargo to the destination in time. In other words, a

shipping line which is behind the scheduled transit time may shift containers between vessels to abolish disruptions in the normal loop timings.²⁷

Diverged strategies are applied by shipping lines while coping with schedule reliability and transit time reliability. Buffers are one of the key decision variables in liner service design. If time buffers in the system decrease, the probability of not meeting reliability targets increases. For example Mediterranean Shipping Company (MSC) allocates low buffer time. That’s why when it comes to the schedule reliability one can say that it doesn’t have best records, however still running with reasonable transit times by directing loops and vessels in a creative way. Creativity here is in the sense of changing the order of port calls for one time and skipping of one or more ports of call through a round voyage. On the other hand for some shipping lines like Maersk Sealand and ACL being stick to scheduled times and the order of ports of call is important. So Maersk Sealand and ACL keep time buffers respectively higher compared to MSC. Result is good reputation of high schedule reliability and consequently also high transit time reliability for Maersk Sealand. By assuring a high schedule reliability and high transit time reliability Maersk Sealand can ask higher price for its service compared to low-cost carrier MSC. Portion of relative importance of each of the sources of schedule unreliability in the liner service schedules on the East Asia–Europe route can be seen in the figure below.

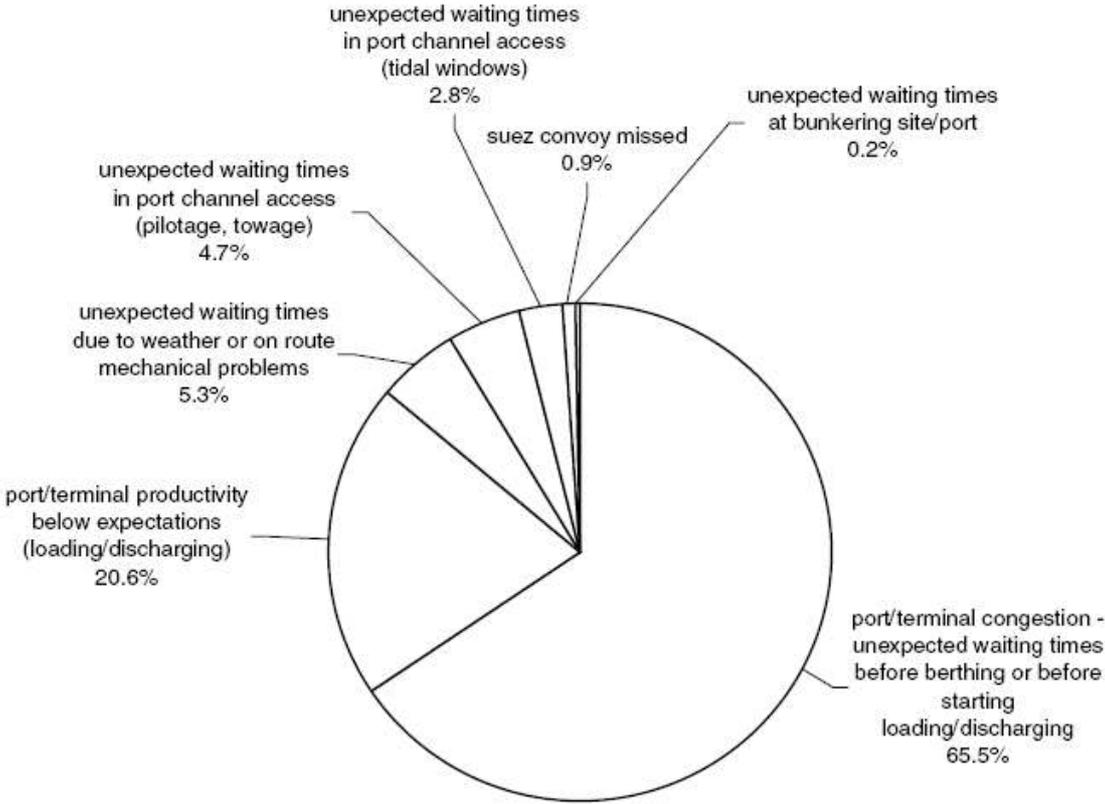


Figure 5: Sources of Schedule Unreliability on the East Asia–Europe Route for the Fourth Quarter of 2004

Source: The Time Factor in Liner Shipping Services, Institute of Transport and Maritime Management Antwerp, Theo E Notteboom

²⁷ The Time Factor in Liner Shipping Services, Institute of Transport and Maritime Management Antwerp, Theo E Notteboom, Institute of Transport and Maritime Management Antwerp, 2000

4.3.4. Sources of Delays and Dealing with Delays

Causes of delays and time losses in vessel operations in a loop can be mainly classified into four groups: terminal operations, port access, maritime passages and chance

There are several possibilities for a shipping line to decrease the level of low schedule and transit time reliabilities. Firstly, rearrange the order of ports of call is widespread practice. Sometimes, discharging more important cargo at the first port of a call can be combined with the transfers of containers over land to destinations near ports that will be visited much later than initially planned. For example if a shipping line decides to change scheduled port order from Le Havre/Antwerp/ Hamburg/Rotterdam to Antwerp/Hamburg/Le Havre/Rotterdam then the bulk of the import cargo intended for French customers will extraordinarily be discharged in Antwerp instead of in Le Havre.

Secondly, one or more port calls can be skipped in order to, decrease total port time and get the vessel back on schedule. Canceling a port of call has a significant effect to increase the cost of land transportation. For example if a specific container has a bill of lading for port Le Havre, but the cargo ends up in port Antwerp because the call at port Le Havre was extraordinarily cancelled, then the shipping line has to organize and compensate for inter-port transport from Antwerp to Le Havre.

Thirdly some other vessels may be organized to take over. Consequently delays of vessels might be compensated by set up the other vessels into the published schedule. Vessels can be deployed again on demand later.

Fourthly, shipping lines might get faster turnaround time at next port(s) of call in the loop to come up to and carry on the schedule. Some container terminals famous for their ability to cancel time lost in other ports. For example, Antwerp is a terminal where high productivities can be achieved in view of bringing a vessel back on schedule.

To conclude, carriers can speed up the intercontinental trunk route in order to be make up time, however increasing vessel speed leads to higher bunker costs. Furthermore using fast vessels will bring about higher capital costs compared to slower vessels, but once a vessel is in service, it is normally assumed that capital costs stay the same. Since the additional costs will be offset by savings in time costs.²⁸

²⁸ The Time Factor in Liner Shipping Services, Institute of Transport and Maritime Management Antwerp, Theo E Notteboom, Institute of Transport and Maritime Management Antwerp, 2000

5. PERFORMANCE EVALUATION OF LOGISTICS ACTIVITIES

5.1. Introduction

Logistics operations for many companies are becoming more vital with the globalization and high level of rivalry. That is why companies are starting to understand the importance of their logistics service performance for their success. Since logistics and transportation involve more strategic concern, measuring and evaluating performance of these activities increase. The accurate assessment of logistics performance will assist the company to shape the attitudes of the managers charged with the duty of developing competitive and operating strategies and also the staff who must execute the strategies.

On the other side, unfortunately all those performance criteria are company based, not integrated in a national or global environment. Nevermore to have an inductive method, we will mention measurement and measurement systems of logistics of entities in overall as they compose a base to our research.

5.2. Performance Measurement System for Logistics Activities

Performance measurement is the practice of evaluating a business system's activities. It can be defined as an assignment method where numbers are nominated to characterize some feature of an object or event of interest for those liable for determining the fate of a business firm. This measurement evaluates current business transactions via objective and scientific values which are appropriate for comparison.

Performance measurement interprets the information of operations related to satisfying customer expectations and strategic aims. To gauge and progress the efficiency and the value of the business processes performance measures are used to.

Commonly, five types of performance measures regarded as vital to achieve logistics activities of the entity.

- ❖ Logistics Quality: Damage in transit, documentation correctness
- ❖ Customer service: Average transit time, transit time inconsistency
- ❖ Asset management: Return on investment, capacity utilization
- ❖ Cost: Cost per hundredweight, transportation cost per unit
- ❖ Productivity: Partial vs. full loads, orders delivered per vehicle

A number of measures from each performance class are normally put in place to supervise and administer a range of logistics functions together with administration, transport, inventory management, order processing and warehousing.²⁹

²⁹ Research on the Performance Evaluation of Logistics Activities, China-USA Business Review, ISSN 1537-1514, USA, Weidong Li* Beijing Jiaotong University

5.3. Evaluation Methods of Performance Measurement for Logistics Activities

Both international and local pundits have come up with various kinds of assessment methods, but the most often used methods are:

- ❖ AHP,
- ❖ Operations research (DEA),
- ❖ Statistic methods (cluster analysis, principal component analysis, factor analysis),
- ❖ Fuzzy evaluation methods and some other similar methodologies.

Here are some of frequent used ones in detailed.³⁰

5.3.1. AHP Method

The AHP, found by T. L. Saaty in 70's of the USA, is a theory to gauge the dealing with quantifiable and intangible items, has been applied to plenty subjects, like decision and conflict resolution theories. It is mainly a sort of multi-hierarchy weighted analytic method and a problem solving structure and a methodical practice for delineating the fundamentals of any problem. The method is derived from comparative judgments, decomposition, and mixture of priorities principals.

First step of AHP method is to decompose a complex, multi-criteria setback into a chain of command. In this hierarchy every phase includes of some controllable items which are then decomposed into another set of items.

The AHP continues with a usage of a measurement methodology to set priorities among the items within each phase of the hierarchy.

The last pace of AHP is to blend the priorities of the items to set the general priorities for the judgment alternatives. The difference of AHP from traditional decision analysis is having no need of decision makers to formulate mathematical predictions as one-sided decisions are simply integrated in the process and the evaluative decisions can be made totally verbally.

It requires less compulsory data therefore AHP can cope with the common evaluation methods which needs extra samples and data, hence building the quantitative analysis among the organized items become likely.

5.3.2. Mathematic Statistics Method

This method covers Cluster, Principal Component and Factor Analysis. Mathematic Statistics Method is a subjective method based on expert's evaluation, thus it can stay away from the human factor's effect. The assessment outcome is only valuable to the decision making and ranking, not presenting the accurate significance degree of the aim in truth.

5.3.3. Fuzzy Comprehensive Evaluation (FCE)

It is generally not easy for estimator to present a quantitative outcome straightforwardly, for the complex goal. Right now, FCE is principally applied to qualitative objective assessment

³⁰ Research on the Performance Evaluation of Logistics Activities, China-USA Business Review, ISSN 1537-1514, USA, Weidong Li* Beijing Jiaotong University

and the method's own excellence. The FCE proposes a type of joined term pretreatment mode to the qualitative information and quantitative information. This evaluation system is also used widely owing to the firm mathematics base and fine formation of the technical system.

5.3.4. Data Envelopment Analysis

*DEA is a linear programming-based technique that converts multiple input and output measures into a single comprehensive measure of productivity efficiency.*³¹ DEA was developed by Charnes A. and the Cooper W. W. and its one of the most common nonparametric methods for economic quantitative analysis. DEA provides measurement through that one firm or department could compare its performance, with other firms or departments. To measure the relativity of efficiencies of organizations, the DEA can be defined as the ratio of entire weighted output to entire weighted input. With DEA each organization can develop different weights to set different performance measures. Weights are chosen that will maximize the combined efficiency score for every functional component. This variable weighting allows the evaluation of performance whilst taking into account differences in goals, responsibilities, and type of procurement.

The method also gives information to the specific effect that each input or output has an overall efficiency, which is useful for measuring logistics performance. In summary, some of the existing problems can be reduced by using DEA when performance evaluation system is point at issue.

5.3.5. Rough Sets

Rough sets approach was developed by Z. Pawlak, in 1982. Qualitative analysis ability is one of the strong characteristics of mathematic description in advance such as membership grade and membership function in fuzzy sets, but it can be directed from the description of settled problem confirmed by the relations that can distinguish or not. This characteristic is similar to the person's view, so rough sets have become more important in recent years. To achieve the purpose, Rough theories have focused on rough sets and other indeterminate calculation.³²

5.4. Measures for Monitoring Transport System Performance

In well developed transportation systems economies of scale create benefits in increased economic and social development. People only travel where they want to go. Therefore, ability to increase benefits to current users of the system is limited, and transportation investments will aim cost reduction or prevention of increased costs results from increased use. Performance measures shows if transportation costs are high, and if there is congestion on roads, as well as infrequent transit service. Increasing net benefits and reduced cost opportunities can be achieved from these situations. *Potential opportunities to improve performance can be measured through street and highway system performance but we can't say the same for performance judging.* Because, we can not limit the amount used. Intelligent transportation systems can be used to take full advantage of capacity and with improving infrastructure, capacity can be increased at the same time. Cost-effective improvements could be used except for a few toll bridges and toll roads, due to their little influence on the time of use. Consequently, the delay level is related to the level of usage. So delay is not sufficient

³¹ Epstein and Henderson, 1989

³² Research on the Performance Evaluation of Logistics Activities, China-USA Business Review, ISSN 1537-1514, USA, Weidong Li* Beijing Jiaotong University

alone for making a decision about performance. A congested freeway could be considered a great success or as a great failure due to usage and the delay that people experience for using it. Some say that, a road which is not congested may mean both success and / or failure because it is not congested or it is not well utilized. For private transportation performance concerns are easier to understand, since consumer surplus and profits are the ultimate indicator of performance. The market assesses performance and sends clues about performance improvement and necessary degree of service supply. Performance standards may reduce net benefits since market is interfered. An example can be air travel deregulation. Before deregulation carriers were required to provide certain level of service, with the deregulation fares and service provided decreased. On the other hand number of passengers increased, that result reveals the passengers' different level of service expectation.

Performance measures should be in line with the primary goals in order to decrease the level of focusing wrong things. This limits the number of performance measures. Since performance measures require collecting and managing a lot of data it is an expensive process. It is important not to forget that performance measures shouldn't be applied if they will not be used as a basis in some decisions. Moreover, expectation such as that a performance measure system can answer all questions may be misleading.³³

5.4.1. Performance Monitoring for State Departments of Transportation

The United State's department of transportation (DOT) uses measures that related to its primary goal of supplying access to activities and minimizing the cost of such access for monitoring performance. Net benefits of the access can not be guessed, but it is likely to figure out indicators such as the number and variety of activities accessed. Number of person-trips, distance traveled per person-miles may be an example. As the number of the trips increase activities accessed also increase.

Variety of activities can be widened for traveling a greater distance. There are some strategies such as putting activities closer to where people live and work. On the other hand, state departments of transportation can not influence land use. They can make use of influence only in a roundabout way, through development of existing facilities and building of new amenities which help new travel patterns and new development. The state DOT doesn't aim to close or reduce capacity of facilities, instead the state DOT's actions lead to increase in travel, supplying increased access for the current travelers and access for new residents. Travel time and accidents are the main indicators of the traveler costs. Accordingly, the state DOT can observe where additional resources are needed to lessen accidents as well as to lessen travel time or delay with the aid of these performance measures.

Allocating resources is important. For instance, if there are two problem locations with equal total person delay and resources provided to diminish delay, the traveler whose delay is higher is chosen to use the resources for. A 2 minute delay experienced by 5000 people is not as bad as a 50 minute delay experienced by 200 people. However if the resources required are not same the decision of resource allocation is more difficult, since there is trade off between benefits.

³³ Research Reports, Definition and Measurement of Transportation System Performance, Joy Dahlgren, 1998, University of California Berkeley

In summary, measures of the amount of transportation provided such as travel time/delay, accidents, and public cost are important performance measures for state DOT's. Also, amount of transportation provided are necessary to see the actual costs.

5.4.2. Monitoring Regional and Local Transportation Agencies

Local transportation agencies have a different emphasis than the state transportation agency. In a sparsely populated region the main problem can be safety while in a large metropolitan area main problem is more likely to be congestion. The problems and the cost of addressing these problems are different. For example, addition of a lane in a rural area is cheaper than in a city. Consequently, tolerance to congestion is higher in big cities as it costs much more to reduce congestion. Also, since there are more miles per person in rural areas there are fewer resources devoted to maintain each mile. In that direction performance measures should not be standard for all regions or cities because standards do not give for weighing the benefits against the costs, and there is no standard that fits for all situations.

5.4.3. Monitoring Ports and Airports

Access, time, safety, and cost values are the same as state and local agencies. Thus, number of passengers and the tons and value of goods passing through the facility should be monitored. The person-delay and the \$ value of freight-delay should also taken into consideration as well as Accidents and costs for capital, maintenance, and operations

5.4.4 Travel Time Measures

Travel time can be counted as the time cost's indicator. Preferably, the volume statistics and the travel time can be transformed into delay statistics, which can be gathered up to the national height.

Regarding to the airport or seaport delays no global, Swedish or US based data was found. On US sources side, only The Federal Aviation Administration has data on air carrier delay by cause.³⁴

³⁴ Research Reports, Definition and Measurement of Transportation System Performance, Joy Dahlgren, 1998, University of California Berkeley

Mode	Measures	Geographic aggregation
<ul style="list-style-type: none"> Autos and trucks 	<ul style="list-style-type: none"> Travel time distribution by time of day 	<ul style="list-style-type: none"> Highway link Arterial Corridor
	<ul style="list-style-type: none"> Average work-trip travel time 	<ul style="list-style-type: none"> Census subdivisions City County Regional Statewide National
<ul style="list-style-type: none"> Transit 	<ul style="list-style-type: none"> Travel time distribution by time of day Service headway by time of day 	<ul style="list-style-type: none"> Route
	<ul style="list-style-type: none"> Average in-service speed 	<ul style="list-style-type: none"> System
	<ul style="list-style-type: none"> Average work-trip travel time 	<ul style="list-style-type: none"> Census subdivisions City County Regional Statewide National
<ul style="list-style-type: none"> Air carriers 	<ul style="list-style-type: none"> Distribution of delay 	<ul style="list-style-type: none"> Airport
<ul style="list-style-type: none"> Marine freight 	<ul style="list-style-type: none"> Distribution of delay 	<ul style="list-style-type: none"> Port

Table 3: General Travel Time Measures for All Modes

Source: Research Reports, Definition and Measurement of Transportation System Performance, Joy Dahlgren, 1998, University of California Berkeley

5.4.5. Performance Measurement of Freight and Public Sector

If we look at the current global situation of freight measurement, the private sector theme and freight performance measurement field majors on building performance measures that measure whether transportation systems are meeting the rising freight demand or not. This field majors on how public organs can gather data from the private sector and reassess gauges which are already build by profit seeking companies as well. The awareness of having a need of performance measurements is raising on public transport organs of many nations. With having the supplementary data, determining the gauges for performance is also very meaningful for transport buyers while it is a big challenge to have these indicators by public transport organs. I.e. transport entities are assessing the freight performance according to delay times at freight bottleneck areas, travel rates, congestion costs and travel times.

On the maritime leg of the subject in United States, The Maritime Administration (MARAD) which is a body department of transportation is exploring the progress of a strong short sea shipping to assist in the cutback of rising freight congestion on America's highway and rail systems. Loads of coalitions (e.g. I-95 Corridor Coalition) are occupied with freight shareholders in their area to agree on the capability Short Sea Shipping operations as short sea shipping is environment friendly and, cost and fuel effective. It is a victorious mean of transport in Europe as well. Short sea shipping was the only way that was able to keep tempo with the expansion of inland haulage at roads in 90's. Especially European Shippers Council

and the UK Freight Transport Association are aware of developing performance measures and indicators in Europe but they don't have a solid proposal also about how to do it.³⁵

There is still a big need of performance indicators to have benchmarking systems either in private sector or in Federal, State, and Local Governments level. The questions like "Do topics such as on-time delivery, system reliability measures exist, can a common metric be developed for both public and private sector to assess freight efficiency issues?" are also appearing.

5.4.6. Performance Measurement in Maritime Transportation

Though all kinds of transportation foster approximately same aims and involve the same characteristics, in detail they show characteristic differences. Regarding marine transportation, current measurement systems based on gauging the financial or technical efficiencies of the transport companies. Additionally besides carriers' efficiency, port or terminal efficiency were examined more and in detail as they offer more tangible quantitative outcomes to measure and understand.

Performance measurement and benchmarking of container terminals:

Port performance and benchmarking approaches can be divided into three main parts as physical indicators, factor productivity indicators, and economic/financial indicators. Nevertheless, in spite of the diversity of existing tools, a reputable structure for efficiency measurement and competitive benchmarking even for ports is not available because there are quite a lot of obstacles for a structure like that, most significantly because of ports' the cross-functional and multi-institutional scope.³⁶

The lack of a national level measurement system in transportation also reflected to any means of maritime transportation as we are seeking tangible methods to measure the cost and time, in other words freight rates and lead times. But tramp shipping industry is a bit luckier than liner shipping industry to have an indexing system for freight rates even though container transportation seems a newer and more modern mode.

The existence of Baltic Exchange, *which is a membership organization at the heart of the global maritime marketplace, maintains independent daily shipping market information; maintain professional shipbroking standards and resolve disputes.*³⁷ Baltic Exchange offers extensive information regarding freight rates in tramp shipping. So it could be useful to figure out what Baltic Dry Index is also.

³⁵ Crystal Jones, FHWA Federal Highway Administration, USA
<http://knowledge.fhwa.dot.gov/cops/pm.nsf/home?openform&Group=PMEE6W7JBM>

³⁶ Performance Measurement and Benchmarking of Container Terminals, Khalid Bichou
<http://www.cts.cv.ic.ac.uk/html/ResearchActivities/projectDetails.asp?ProjectID=338>

³⁷ Baltic Exchange, <http://www.balticexchange.com/>

5.4.6.1. Baltic Dry Index

*The Baltic Dry Index, or BDI, is an index of twenty-two key dry bulk shipping rates and is compiled daily in London. This index provides an assessment of the price of moving raw materials such as iron ore, grains, coal, and cement by sea. This index does not include wet goods such as crude oil.*³⁸

The index is not a tradable deal because of not involving a direct tentative element since deals involve a tentative element which can affect the cost of shipping.

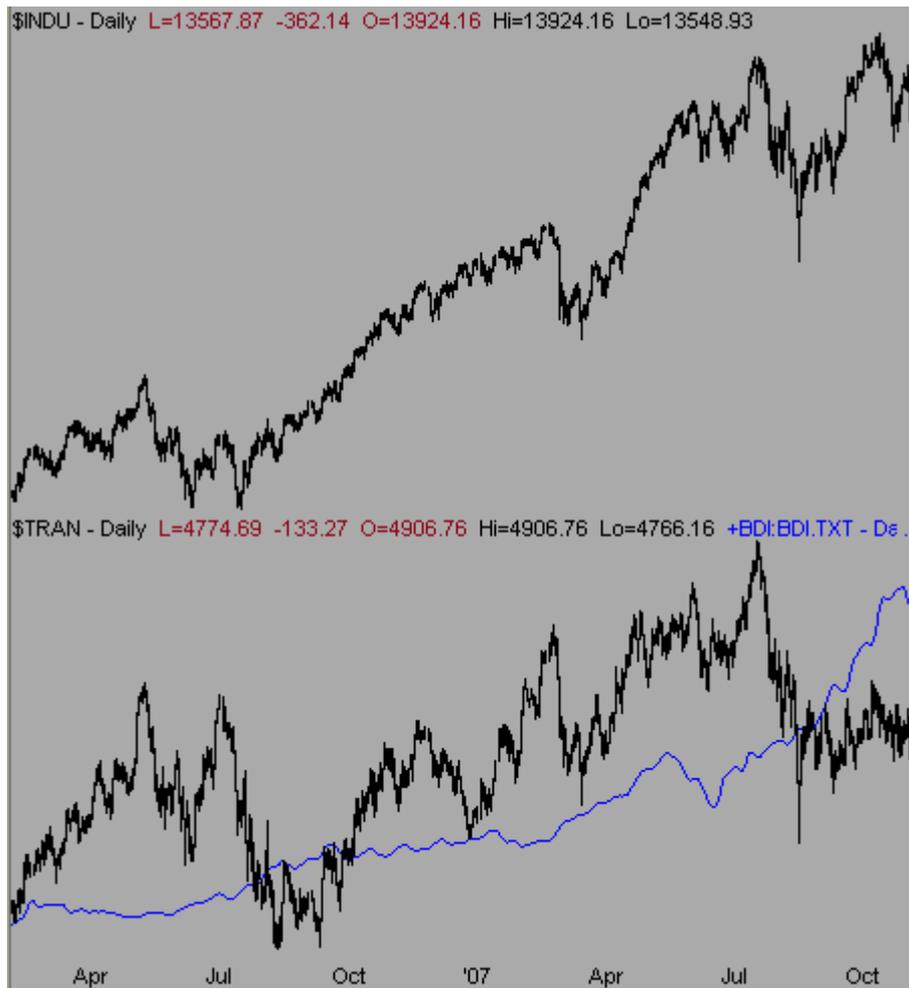
According to October 2007 data, one element that has speculative component is crude oil, by to the degree that 30%. U.S. Dollar is the other one speculative component. The index is being quoted in dollars, for that reason any sharp fall in the dollar causes vertical rise in the index.

A question aiming to learn about how much it costs to ship dry goods by sea, emerges for an investor or trader.

In order to have an idea about the volume of world trade, sea transportation can be a good indicator. Since the raw goods shipped will be used in production soon, this index is a good economic indicator for the future growth and production. Besides, as the number of the ships on hand is fixed, supply and demand will cause the price of shipping go up or down. If the world growth speeds up shipping raw goods will likely increase and if growth slows the cost of shipping raw goods will decrease.

But even Baltic Exchange is unique and many of the business people are benefiting every day, on the name of indexing everything is not perfect.

³⁸ Doug Tucker, Baltic Dry Index, <http://tuckerreport.com/articles/baltic-dry-index/>



Source: Tucker Report, <http://tuckerreport.com/articles/baltic-dry-index/>
Figure 6: Baltic Dry Index

In the figure above Dow Industrials is in the upper graph and the Dow Transports is in the lower graph. One can realize that the last high in the Industrials was not verified by the Transports. The new high only took place in the Industrials in the upper graph. But if BDI, the blue line, is taken into account the high in the Industrials is confirmed.

With the participation of China and other emerging markets to the world economy, economy has become more global. As a result, need for different types of transportation index have emerged. The Dow Jones Transportation Average consists of stocks of companies beyond just the components that transport raw and finished goods. For instance, airlines transporting people and small packages are also taken account of. Although that may show current economic activity, it does little to predict future economic growth in the way raw goods can. Since much of the activity is domestic, it is not representative for the global picture. Measurement of the actual cost of transporting the raw goods rather than the valuation of the stocks of transportation companies may be more direct indication of the trend of economic activity. If a transportation average does not verify an industrial average at a new high or low, it may be wise to also check to see if the BDI is giving a more meaningful confirmation.³⁹

³⁹ Doug Tucker, Baltic Dry Index, <http://tuckerreport.com/articles/baltic-dry-index/>

5.4.6.2. Key Performance Indicator Offerings for Containerized Transport Based on the Case Cities Table



Figure 7: Locations of Chosen Swedish Cities for the Sample Cities Table
 Source: Google Earth

From/to Companies in		From/to Companies in	
Sundsvall	Port with container terminal	Frankfurt	Port without container terminal
Uppsala	No container terminal	Paris	Port with container terminal
Trollhättan	Lake port, no container ter.	St. Petersburg	Port with container terminal
Jönköping	Inland	Boston	Port with container terminal
Malmö	Port with container terminal	Shanghai	Port with container terminal

Table 4: The Sample Cities
 Source: SMA

Indicator Suggestions for Price

After gathering all related data, these conditions can be measurable easily:

- ❖ Each company’s annual freight rate trends for a certain export route
- ❖ Different companies’ annual freight rate trends for a certain export route

- ❖ Each company's freight rate difference between a certain export route and same import route
- ❖ All companies' freight rate difference between a certain export route and same import route (The price difference can show the overall trade imbalance if many companies have a parallel trend on same route)
- ❖ The comparison of South Sweden originated exports (or imports) to North Sweden originated exports (or imports) by the formula of [(The port to port transportation cost / mile) – handling costs of included ports]
- ❖ The comparison of a company's certain export route (or import) with other companies' same export (or import) route by the formula of [(The port to port transportation cost / mile) – handling costs of included ports]
- ❖ The difference between the fixed conference rate price and a company's current price

Indicator Suggestions for Time

- ❖ The lead time differences of different companies is same route and their trends
- ❖ Frequency of delays of the companies, comparison between the actual lead-time and promised lead time on a certain route
- ❖ Annual lead time recovery rate of each company on a certain route
- ❖ Average of the lead time recovery rates of all companies on a certain route

If the data is starting with the year of 2006, the year of 2006 must be the base year for comparison. As price of 2006=100 other years increase or decrease can be shown by a percentage referenced with year 2006. The simplest lead-time or price trends over a year can be mentioned consequently.

6. CONCLUSIONS

It is obvious that there is a big need of measuring how transport companies are continuing their marketing activities individually on price and time aspects. Firms are already using some interior benchmarking systems or performance measurement systems for their own sake but on the other hand there is a gap for same kind of application on an integrated and national level. Either on a national or firm based level of any kind of transportation mode, those performance measurement systems are much more on the technical or financial side of the performance.

The list of performance measures for all modes of transportation can be found which can be an overview and a comparison among modes.

Summary of List of Performance Measures for all Modes

There are some activities which are unlikely to measure such as benefits of access to activities or markets. Nevertheless, these benefits can be incidental from the amount of transportation consumed. Number and range of activities increase as the number of trips and distance traveled raise. Considering freight trade benefits increase with the ton-miles (or \$ value-miles) some general transportation measures are listed in table 5 which are facility based. Non-motorized modes or most local streets are not included in the table. Traveler-based information on travel patterns is required to provide this information, in addition to clarify the observed patterns of facility use.

Mode	Measures	Geographic aggregation
<ul style="list-style-type: none"> Autos and light trucks 	<ul style="list-style-type: none"> Person-miles – highway 	<ul style="list-style-type: none"> Link Corridor Regional Statewide National
	<ul style="list-style-type: none"> Person-volume – streets 	<ul style="list-style-type: none"> Arterial link
<ul style="list-style-type: none"> Transit 	<ul style="list-style-type: none"> Passenger-trips Passenger-miles 	<ul style="list-style-type: none"> Route System Regional Statewide National
<ul style="list-style-type: none"> Inter-city bus and rail Commercial airlines 	<ul style="list-style-type: none"> Passenger-trips Passenger-miles 	<ul style="list-style-type: none"> Corridor Statewide National
<ul style="list-style-type: none"> Private airplane 	<ul style="list-style-type: none"> Passenger- trips 	<ul style="list-style-type: none"> Airport Regional Statewide National
<ul style="list-style-type: none"> Truck freight Rail freight 	<ul style="list-style-type: none"> \$ value-miles or ton-miles 	<ul style="list-style-type: none"> Corridor Statewide National
<ul style="list-style-type: none"> Air freight 	<ul style="list-style-type: none"> \$ value-miles or ton-miles 	<ul style="list-style-type: none"> Corridor Statewide National
	<ul style="list-style-type: none"> \$ value or tons 	<ul style="list-style-type: none"> Airport
<ul style="list-style-type: none"> Marine freight 	<ul style="list-style-type: none"> \$ value-miles or ton-miles 	<ul style="list-style-type: none"> Trade route
	<ul style="list-style-type: none"> \$ value or tons 	<ul style="list-style-type: none"> Port

Table 5: Volume of Transportation --- Indicator of Access

Source: Research Reports Definition and Measurement of Transportation System Performance, Joy Dahlgren, 1998

When we limit the transportation subject especially with marine container freight, we focus on the schedules, transit times and freight rates in liner shipping which are majoring the factors of our accessibility point of view and which are discussed in chapter 4 in dept.

Findings for Liner Transportation

Theoretical findings and analysis results of the sample cities table have already been discussed at the price and time indicators section of chapter 5. If it is needed to sum up, they indicate that, having a clear indexing system in liner shipping by only looking to costs and times is not very feasible because of nature of container freight market though some basic benchmarking ways for the routes, companies and time periods which was reached by our questionnaire —touching many ocean freight providers to Sweden with this approach— can be done.

In detail, variations of the comparisons of freight rates among different companies or within a specific company or with a liner conference published rate and comparisons of lead time trends seems feasible.

Finally it is necessary to point out that there were two fundamental bottlenecks to conclude to subject with more solid and useful findings. Restricting the subject only by cost and time perspectives, which was required by SMA, didn't work well to reach a national level

evaluation or assessment. Some more parameters could be added in order to make a formula or equation. Moreover there was no specific thesis, course book, or even a sector-specific article about developed indicators or measurements so far or how to develop indicators or measurements for our specific subject especially in any national level.

On the other hand, time and cost is the one of the most sensitive subjects for the firms which is hard to share with someone else continuously and accurately. So data gathering phase was rather problematic for that reason. Out of 23 transportation related companies, only one of them answered our questionnaire by postal mail and three of them replied us by email. Precisely this much data was insufficient to make any kind of real comparison or benchmarking.

7. RECOMMENDATIONS

The recommendations for liner shipping will actually base on the sample cities table. We have already mentioned the feasible indicators in the analysis part of the chapter 5 and in chapter 6. But besides those findings here are some recommendations about sources of data, developing indicators and discussion about the nature of data:

A. About Data Gathering

In our opinion, the most accurate results come after finding and collaborating with all transport related companies in Sweden and all other companies who are realizing the exportation physically with a control of seeing whether they are same companies or not. All these companies' detailed freight rates and lead times must be gathered annually or even quarterly.

For this kind of research some market research companies like Bharat Book Bureau can be utilized. Bharat Book Bureau which provides business intelligence for strategic excellences to companies has a unique database only for its members about market based container freight rate benchmarks and more. Bharat's special product, container shipper insight, is released quarterly and especially covers port to port freight rates, their benchmarking and freight rate forecasts which can be an invaluable database.⁴⁰

Containerization International⁴¹ who has direct relationship with the research and reports of United Nations, could also be another serious source. It might provide the needed data with a governmental level of collaboration. Thus sensitive data can be shared and the tracks of those data can be recorded at Swedish Statistics Institute i.e.

Additionally we think that, if the sample export shipping table nominated by SMA had covered by past 10 years annual freight rate, lead time and distance data via any ways of data supporting we have mentioned, a regression analysis could be applicable to forecast 2008's freight rates. In order to launch this regression analysis, instead of 10 years annual data 3 years quarter yearly data can also be implemented. Afterwards the result of the forecast could be compared with the targeted year's actual freight rate.

B. About Formulating Indicators

If we assume a regression analysis was supported by adequate data, first of all the regression analysis must be done for each company's each route. All companies' prices can be averaged for the same export or import route. Finally, an average can be found for north of Sweden and another average for south of Sweden.

If we accept Sundsvall and Uppsala cities as the north cities, their average can be found by summing up their rates. In order to find south Sweden's rates, rest of the cities in the table can be calculated with same method. Consequently south and north parts of Sweden have the form which is comparable.

⁴⁰ Bharat Book Bureau http://www.bharatbook.com/businessreports/Container_Shipper_Insight.htm

⁴¹ Containerization International, <http://www.ci-online.co.uk/>

C. About the Nature of the Data

Not only TEU commodities have to be gauged but also (Forty-foot Equivalent Unit) FEU commodities have to be included on another scale.

The empty returning containers are also an opportunity cost item to the national economy. So the yearly difference between empty and full container handling rates can be another item to gauge. For ex: Which cities or ports gather more empty containers.

Though it is complex to have a measurement system for port to port transportation, it is more complex to gauge such data in door to door transportation. After the main or feeder ocean transportation, a truck or train transportation is including to door to door transport. Sometimes some companies are transporting the goods by trucks even though they told their customer that they were going to transport by air. It is just because of the road transportation is more flexible and responsive to door to door transport needs. Despite air transportation is the fastest way because of its inflexibility; sometimes road transport becomes faster on total transit time. While the cargo is transshipped from the airport, direct transported truck cargo will have arrived.

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APPENDIXES

I. The Questionnaire Letter

Dear Sirs,

This is a follow-up letter to a previous telephone call, Wednesday November 14, about accessibility to international destinations for Swedish industry.

We are two students from the School of Economics, Business and Law at Göteborg University (Handelshögskolan) writing our Master Thesis. We are currently initiating an explorative study for the Swedish Maritime Administration (Sjöfartsverket) about key indicators. We are trying to develop a methodology to assess the accessibility for different cities in Swedish in containerized trade. To be able to create a small time series for reference we kindly request your participation to fill in the table included. We would like you to fill in the price for a standard door to door export-price of 1 TEU standard container* to the destination given. Prices given should be an approximate yearly average for the three years 2005 – 2007. The survey covers 23 companies and we would be most grateful to have the filled in form returned by December 3.

To make sure that the information you supply will not be made available to others in the market, we request you to return it to our contact person, Mr. Alf Brodin at Sjöfartsverket, who will code the companies before sending the data on to us. We will then only see what kind of company has supplied the data, not the name of the actual company as a way to secure the confidentiality of all data. You can also reply by email to alf.brodin@Sjofartsverket.se.

The need for Sjöfartsverket to try different ways to develop a methodology for accessibility derives from the fact that the Swedish Government demands Sjöfartsverket to yearly assess changes in accessibility (focusing on cost and time) for Swedish industry. If you would happen to have an idea about a suitable and reliable methodology to do this, we, as well as Sjöfartsverket, would much appreciate to discuss this.

We expect the results of this project to be included in Sjöfartsverkets Sektorsrapport for 2007, which will be published in May 2008. Our Master Thesis will also be made available for all respondents.

Kind Regards,

Yekta Doğan

Çınar Sözer

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Co-ordinator:

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Alf Brodin, Project Manager

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Export Data Table from Swedish Cities to Foreign Destinations*

	From		To	Price 2007 in SEK	Price 2006 in SEK	Price 2005 in SEK	Current Expected days of transport	Expected route distance
A.	Sundsvall	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai					
B.	Uppsala	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai					
C.	Trollhättan	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai					
D.	Jönköping	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai					
E.	Malmö	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai					

*Shipment details for all destinations: 1*20 dc 16 580 kg, souvenir, in boxes, CIF prepaid

IF there are cities on the list that you do not have quotations for, please exclude these.

II. Feedback from Company A

Export Data Table from Swedish Cities to Foreign Destinations*

	From		To	Price 2007 in SEK	Price 2006 in SEK	Price 2005 in SEK	Current Expected days of transport	Expected route distance
A.	Sundsvall	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	22400	23100	23500	20	
		4.	Shanghai	14200	14600	14900	33	
B.	Uppsala	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	17800	18300	18700	20	
		4.	Shanghai	9556	9850	10030	33	
C.	Trollhättan	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	15400	15860	16170	20	
		4.	Shanghai	8700	8960	9140	33	
D.	Jönköping	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	16400	16900	17200	20	
		4.	Shanghai	9500	9800	9975	33	
E.	Malmö	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	15300	15760	16065	20	
		4.	Shanghai	9300	9600	9800	33	

*Shipment details for all destinations: 1*20 dc 16 580 kg, souvenir, in boxes, CIF prepaid

IF there are cities on the list that you do not have quotations for, please exclude these.

III. Feedback from Company B

Export Data Table from Swedish Cities to Foreign Destinations*

	From		To	Price 2007 in SEK	Price 2006 in SEK	Price 2005 in SEK	Current Expected days of transport	Expected route distance
A.	Sundsvall	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	22400	23100	23500	20	
		4.	Shanghai	14200	14600	14900	33	
B.	Uppsala	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	17800	18300	18700	20	
		4.	Shanghai	9556	9850	10030	33	
C.	Trollhättan	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	15400	15860	16170	20	
		4.	Shanghai	8700	8960	9140	33	
D.	Jönköping	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	16400	16900	17200	20	
		4.	Shanghai	9500	9800	9975	33	
E.	Malmö	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston	15300	15760	16065	20	
		4.	Shanghai	9300	9600	9800	33	

IV. Feedback from Company C

Export Data Table from Swedish Cities to Foreign Destinations*

	From		To	Price 2007 in SEK	Price 2006 in SEK	Price 2005 in SEK	Current Expected days of transport	Expected route distance
A.	Sundsvall	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai	9900	10900	11200	41	
B.	Uppsala	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai	8400	9400	9700	40	
C.	Trollhättan	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai	7400	8400	8700	40	
D.	Jönköping	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai	7800	8800	9100	40	
E.	Malmö	1.	Frankfurt					
		2.	St Petersburg					
		3.	Boston					
		4.	Shanghai	6200	7200	7500	40	

*Shipment details for all destinations: 1*20 dc 16 580 kg, souvenir, in boxes, CIF prepaid

IF there are cities on the list that you do not have quotations for, please exclude these.

V. List of Companies that the Questionnaire Letter has been sent

No	Company	Contact Person	Address	Phone, Fax	Other
1	K Line	Line Manager Peter Pettersson Ppe@Kline.Se	“K” Line (Sweden) AB 21, Föreningsgatan, P.O. BOX 2116, SE-403 12 Göteborg	Tel: 0046317789111	
2	Maersk		Maersk Sverige AB (HQ) Mölnadalsvägen 24, Box 1115 Zip: 405 23, Gothenburg	Phone: +46 31 751 1000 Fax: +46 31 751 2182	
3	Schenker AB	Johan Röstin Manager Air & Sea Freight Johan.Rostin@Schenker.Com	Schenker AB 412 97 Göteborg	Phone: +46 31 703 80 00 Fax: +46 31 40 75 22	Info.Se@Schenker.Com
4	DHL Global Forwarding	Kennet Lundqvist Managing Director DHL Global Forwarding Kennet.Lundqvist@Dhl.Com		Phone: 0771-400 400	
5	NYK		NYK Group Europe Ltd - Scandinavian Region Forsta Langgatan 16 P. O. Box 31159 S-400 32 Gothenburg	Phone: 46-31-7045400 Fax: 46-31-7045407	
6	Aseco	Gunilla Welander Line Manager Gunilla.Welander@Aseco.Se	Packhusplatsen 2 Box 114 55 S-404 30 Gothenburg	Direct: +46 31 743 77 10 Mobile: +46 736 00 98 88	
7	Unifeeder	Managing Director Mr Lars Rexius E-Mail: Lre@Unifeeder.Com	Unifeeder Sweden AB, Gothenburg Sydatlanten, Skandiahammen S-403 36, Gothenburg	Tel: +46 31 64 46 81	
8	CMA CGM	Eva Ollson	Branch Of CMA CGM Scandinavia AS Berzeliigatan 14 PO Box 530 30 Town Goteborg SE 400 14	Phone 46 31 708 2830 Fax 46 31 708 2849	
9	HAPAG-LLOYD	Director Sales Marketing Niels Augustenborg Niels.Augustenborg@Hlag.Com	HAPAG-LLOYD (SWEDEN) AB BOX 213 S-401 23 GOETEBORG	Phone: (0)31/3378200 Fax: (0)31/195890	
10	Dasena Agencies AB	Mogens Klintemark Mkl@Dasena.Dk	Dasena Agencies AB Packhusplatsen 2 S-411 13 Gothenburg	Phone: +45 36 98 26 64	

11	Scandinavian Shipping And Logistics	Stuart Smith Phone: +46 (0) 708 85 00 03 Email: Ssh@Scandinavianshipping.Com	Scandinavian Shipping And Logistics P.O. Box 1039 SE-405 22 Gothenburg	Phone +46 (0) 31 85 75 60 Fax +46 (0) 31 24 31 48	Shipping@Scandinavianshipping.Com
12	Atlantic Cargo/ Stat Shipping		Atlantic Cargo Services (ACS) AB 55 00 Skeppsbroplatsen 1 S-411 18 Gothenburg	Tel: 46-31-339 Fax: 46-31-13 17 63	E-Mail: Acs@Atlanticcargo.Com
13	Contralo Scandinavia AB	Sales Marketing Manager Stefan Anson	Contralo Scandinavia AB Första Långg. 20 41328 GÖTEBORG	Tel. 031 - 704 89 00	
14	Hamburg Süd Norden AB	Peter Lidstrom	Hamburg Süd Norden AB Gullbergs Strandgata 4 PO Box 1066 40522 Gothenburg	Phone: +46 31 755-4400 Fax: +46 31 755-4441	Peter.Lidstrom@Got.Hamburgsud.Com
15	Kuehne + Nagel AB		Kuehne + Nagel AB Gullbergs Strandgata 8 Gothenburg Postal Code40121	Phone +46-31-7077700 Fax +46-31-7077707	Info.Gothenburg@Kuehne-Nagel.Com
16	OOCL	Customer Service Outbound Ulrika Carlsson Ulrika.Carlsson@Oocl.Com (46) 31 335 59 03	OOCL (Sweden) AB 2nd Floor, Hiss B, Drakegatan 7, S412 50 Gothenburg	Telephone: (46) 31 335 5900 Fax: (46) 31 403 390	
17	MSC SWEDEN AB		MSC SWEDEN AB Skeppsbron 5-6 P.O. Box 2226 SE-403 14 GOTHENBURG SWEDEN	Phone+46 31 339 4900 Fax+46 31 339 4910	Info@Got.Mscsweden.Com
18	NTEX AB	MANAGING DIRECTOR: THOMAS STROM Thomas.Strom@Ntex.Se	NTEX AB P.O. Box 8702 SE- 402 75 Gothenburg	Phone: +46 (0) 31 - 727 85 05 Mobile: +46 (0) 708 - 61 42 90 Fax: +46 (0) 31 - 727 85 99	
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21	PFC AB	Export Traffic, Jan-Olof Lundahl Jan.Lundahl@Pfcab.Se	PFC AB Bassänggatan 5 415 25 Göteborg	Tel. +46 (0)31 434570 Fax. +46 (0)31 434587	
22	Infranordic	Joakim Christensson Sales Manager Phone: +46 - 31- 333 27 80 Cell: +46 - 704 - 93 67 69 Joakim@Infranordic.Se	Infranordic Shipping & Forwarding AB Klippan 1A Box 12073 S - 40241 Gothenburg	+46 - 31 - 333 20 80 (Phone) +46 - 31 - 333 20 90 (Fax)	
23	Transflex	Market / Sales Nils Wadman +46 (0)31-742 88 35	Transflex I Göteborg AB Kårebogatan 10, SE-418 78 Gothenburg	Tel: +46 (0)31 742 88 30 Fax: +46 (0)31 742 88 39	Mail@Gbg.Transflex.Se