

KYMENLAAKSON AMMATTIKORKEAKOULU

University of Applied Sciences

Master's Degree Programme in International Business Management

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ACTIVITY-BASED COSTING

CASE: DFDS LOGISTICS

Master's Thesis 2010

ABSTRACT

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Activity-Based Costing - Case: DFDS Logistics

Master's Thesis

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Activity-Based Costing has been successful in large-scale industries for improving the operational performance by providing appropriate and accurate information on the consumption of resources. Despite the fact that Activity-Based Costing has an important role in improving performance of large-scale companies, it has not received significant attention from small and medium-sized businesses, although activity-Based Costing has been used and studied extensively in large-scale companies.

This study focuses on Activity-Based Costing in small and medium-sized logistics company called DFDS Logistics. More specifically, this study focuses on transport costs of DFDS Logistics which occur in Finland. DFDS Logistics is a service company. All trucking, reloading and transport services are subcontracted from other companies in Finland. In this study Activity-Based Costing calculations are done from three different loading places with three different prices per kilometer to seven ports in Finland.

As a result of the study it can be said that distance between loading place and port determines strongly the total costs in Finland. Therefore the closest ports should be used for shipments from Finland to specified ports on the Continent if it is possible and sea freight is at same level between ports. Based on these findings DFDS Logistics should investigate possibilities to expand operations in future to all main ports of Finland that can be used for shipments of trailers to the Continent. Based on the fact that DFDS Logistics is owned by shipping company DFDS A/S, these investigations can be part of market research of shipping branch analysis in Finland.

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1. INTRODUCTION

1.1 Background

Companies need information about their operations. Different companies need different kind of information. Certain information is more valuable to some companies compared to other companies. Information is needed so that companies could make better decisions and companies could be more effective in today's business world.

One way to obtain information is to analyze costs within the company. Generally costs can be divided to direct costs and indirect costs. Special interest in cost allocation is in indirect costs. Indirect costs make up an important part of companies costs. A company can be more competitive and respond better to customers needs at long run when a company is aware of its cost structure and accumulation of costs. (Vehmanen 1997.)

One method of allocating costs is called Activity-Based Costing (ABC) (Vehmanen 1997). Activity-Based Costing has been successful in large-scale industries for improving operational performance by providing appropriate and accurate information from consumption of resources. Despite the fact that Activity-Based Costing has an important role in improving performance of large-scale companies, Activity-Based Costing has not received significant attention from small and medium-sized businesses (SME). Because majority of companies are small and medium-sized companies, it is important to these companies to realize also advantages of accurate information and allocation of costs.

Activity-Based Costing has been used and studied extensively in large-scale companies. However, there is a lack of studies that focuses on Activity-Based Costing in small and medium-sized logistics companies. This study focuses on Activity-Based Costing in small and medium-sized logistics company called DFDS Logistics.

DFDS Logistics is a logistics division of DFDS A/S. DFDS A/S is a leading North European liner shipping company. DFDS A/S was founded in Denmark and company

is listed on NASDAQ OMX the Nordic Exchange Copenhagen. DFDS Logistics is a name for land-based transport activities of DFDS A/S. (Frontpage – DFDS.)

1.2 Settling the Topic

The main focus in this study is in logistics costs of DFDS Logistics which occur in Finland. Keeping costs in control at the long run is important for any company in any line of business. Logistics companies are under tight competition as most of companies are in any line of business. Therefore costs must be kept in control.

Cargo flows have been declining for a few years, but a turn in seems to be at hand. As a result of investments in recent years, most logistics companies have unused capacity. A challenge in this kind of business environment is to find out how to do profitable logistics business at the long run by keeping costs in control, customers satisfied and make also profit for shareholders of the company.

The main objective of this study was to reveal and optimize transport costs in Finland. The objective was also found out which Finnish ports DFDS Logistics could use to its operations in Finland at cost point of view and what ports DFDS Logistics should use at cost point of view. This study focuses on costs occurred in Finland. Sea freight levels from ports to the Continent, service levels of stevedoring companies and ports or liner service timetables of shipping companies will not be evaluated or analyzed. This study describes and reveals the cost structure and accumulation of costs of DFDS Logistics in Finland.

Also, one objective of the study was to find out what would be an ideal mix of ports in Finland from the cost point of view. One potential result of the study is that there is no ideal mix of ports. The present situation is that mainly two ports are used. Port of Hamina and Port of Rauma are main export ports of DFDS Logistics in Finland. DFDS Logistics is also using Port of Helsinki, Port of Hanko and Port of Kotka for shipping trailers from Finland to the Continent but use of these ports is occasional. This study is seeking answers to the question, which loading destinations should be taken care of via which ports.

This study concentrates on trailer logistics. Containers, reefers and swap-bodies will not be analyzed.

Capital costs of trailers will not be part of this study because DFDS Logistics in Finland does not own the trailers. Trailers with Halléns logos on side are owned by DFDS Logistics in Belgium and other trailers are rented or owned by some other company within DFDS group. Capital costs of trailers must be certainly taken into account when prices are calculated for customers; prices are settled and offered to customers.

The present study does not take empty kilometers from unloading or parking place of empty trailers to loading place into consideration. Almost in all cases there are empty kilometers between unloading place and loading place. The ideal situation would be a case when unloading and loading could be done at same yard without moving the truck, which happens very infrequently. Therefore a certain number of empty kilometers must be taken into account when pricing of transport is done. Empty kilometers are naturally the most expensive kilometers.

Capital costs of trucks will not be part of this study. In Finland DFDS Logistics is a service company which sells international trailer transport services to mainly manufacturing companies. DFDS Logistics does not own the trucks in Finland. (Halléns nv.) Trucking services are bought from subcontractors. Subcontractors of DFDS Logistics in Finland are Oy TransPeltola Ltd, Pasi Trans Oy and Koskinen-yhtiöt. Trucking costs in Finland are priced as a fixed price per kilometer. This fixed kilometer price includes all costs of the truck including diesel fuel as well as the salary of the driver.

This study concentrates only on the costs of DFDS Logistics in Finland. Costs used in calculations of the study are from financial statements of DFDS Logistics Oy. Financial statements are from financial year 2009. Some yearly expenses are estimations based on monthly costs. Expenses which are not related to operations such as entertainment expenses and concert tickets are not included. Otherwise all costs are taken into account in calculations and results present minimum absorption costs.

2. THEORETICAL FRAMEWORK - ACTIVITY-BASED COSTING

Management accounting in the United States, including cost accounting, developed much sooner in the United States than in the United Kingdom or in the Europe. First thoughts related to Activity-Based Costing were presented around year 1900 (Johnson 1987, 142). Cost accounting practice became increasingly dominated during the 1920s in the United States. J. Maurice Clark from University of Chicago was one of the earliest and one of most influential writers who understood the difference between variable and fixed costs. Difference between variable and fixed costs is meaningful in making of long term and short term decisions (Johnson 1987, 153-154). William Vatter from University of Chicago continued J. M. Clark's work. Around mid-1940s Vatter published a paperback where he recommended two different accounting systems. Vatter's recommendations were not adopted at 1940s (Johnson 1987, 159-162). In the 1970s Danish Vagn Madsen published a book called *Regnskapsvaesenets oppgaver og problemer*. Basics of Activity-Based Costing has been known in Finland at least since Madsen's book was published in Swedish at name of *Redovisningens roll i 70-talets styrsystem*. (Alhola 2000, 15.)

Activity-Based Costing has been in the knowledge of general public at least from year 1987 when H. Thomas Johnson and Robert S. Kaplan published their book named *Relevance Lost: The Rise and Fall of Management Accounting*. This book underlined problems of cost accounting which had been a topic of discussion for a long time. (Alhola 2000, 14-15.)

All the way to middle of 1990's companies mostly used Activity-Based Costing for specific tasks. Long-term use of Activity-Based Costing was unusual. In Finland during depression of 1990s Activity-Based Costing was used solving specific problems. These problems could be related to products or services or they could be a part of the process of increasing companies cost efficiency. (Lumijärvi et al 1995, 21.)

The changing world, change of production process and new technology will create new challenges to companies. Traditional cost accounting is developed during a time when markets were stable and production technology was simple. Nowadays companies are more customer-oriented. Well-advanced technology has enabled wider

offering of more complicated products and services. These products and services have changed structure of cost in companies which has increased pressure for inventing better cost accounting systems. (Alhola 2000, 16.)

Activity-Based Costing and cost accounting are often compared to each other. Activity-Based Costing is seen sometimes as competitor or threat to cost accounting. This is not the case. Activity-Based Costing is rather method for justified allocation of cost to cost centers (Alhola 2000, 10-16). One weakness of cost accounting is the use of volume-based cost allocation. This has lead to deviation in calculation of product costs. Deviations are risks to companies in making of pricing decisions or investing decisions. Products may be over or under priced or investments could be unprofitable because of miscalculations in cost accounting. (Paavola et al 1997, 78.)

2.1 Activity thinking

Selling products at a profitable price is a cornerstone for profitable business. Manufacturing products demand activities as well as achieve activities in companies. Activities are work to be done in companies such as offer calculation, receiving an order, setting machines, manufacturing products, packing products and delivery of products. In activity thinking it is important to pay attention to objects that use these activities. These kinds of issues are among other things different products, customers, distribution channels, projects and market areas. Naturally there are variations between companies. The most important in activity thinking is to realize that company needs resources for working and activities use these resources. Use of company resources creates costs. It is important to know how companies use their limited resources. (Alhola 2000, 27.)

Activity thinking is a wider concept than just cost accounting. In the late 1990s concept of activity thinking transformed itself to Activity Based Management (ABM). It is typical of Activity Based Management that it uses and combines different management styles such as Total Quality Management and Time Based Management. (Alhola 2000, 96.)

The difference between Activity Based Management and Activity-Based Costing is that Activity-Based Costing focuses on cost accounting whereas Activity Based Management focuses on continuous improvement of activities. Actions of Activity Based Management are based on accounting results of Activity-Based Costing. (Lumijärvi et al 1993, 36-37.)

2.2 Activity chain

Activity chain is a broad overview of activities. It is typical of activity chain that they have customers. Activity chains will go over company structures from department to department. Selling and delivering a service or product to customer is a typical example of activity chain. (Lumijärvi et al 1995, 34.)

Typically an impulse from outside an organization will start an activity chain in organization. This chain is described in Figure 1 below. Impulse will lead to several sequential activities and activity chain will be created. (Alhola 2000, 27-28.)

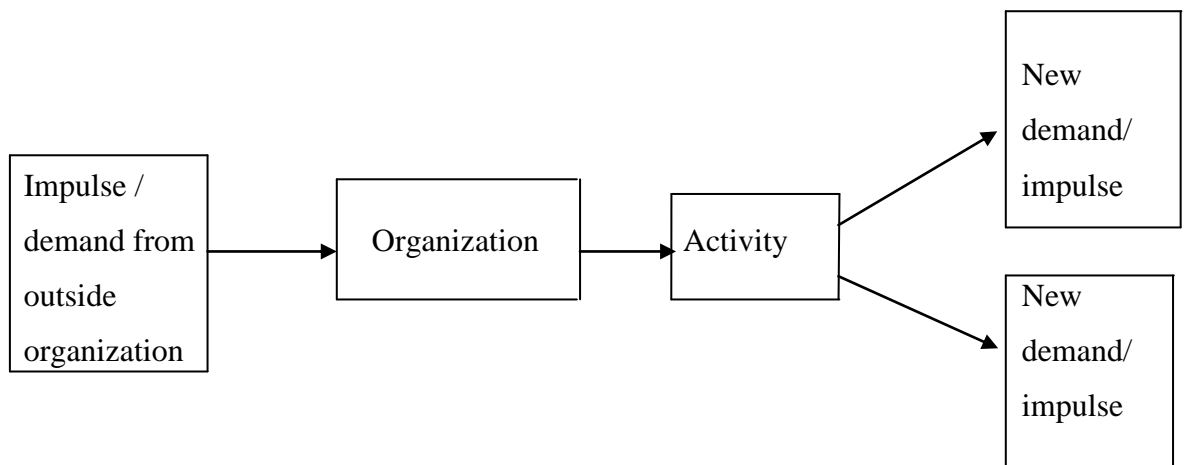


Figure 1. Impulses start activities (Alhola 2000, 28)

2.3 Dimensions of Activity-Based Costing

Activity-Based Costing can be observed from two different dimensions. Dimensions are presented in Figure 2 below. These dimensions are allocation dimension of cost, and process dimension of costs. Allocation dimension of costs will give information from resources, activities and calculation objects. The purpose of cost allocation is to find out total costs of calculation objects. Resource drivers are used to allocate

resource costs to activities. Activity drivers are used to allocate activity costs from activities to calculation objects. Allocation is done on based of drivers. (Vehmanen 1997, 130-131.)

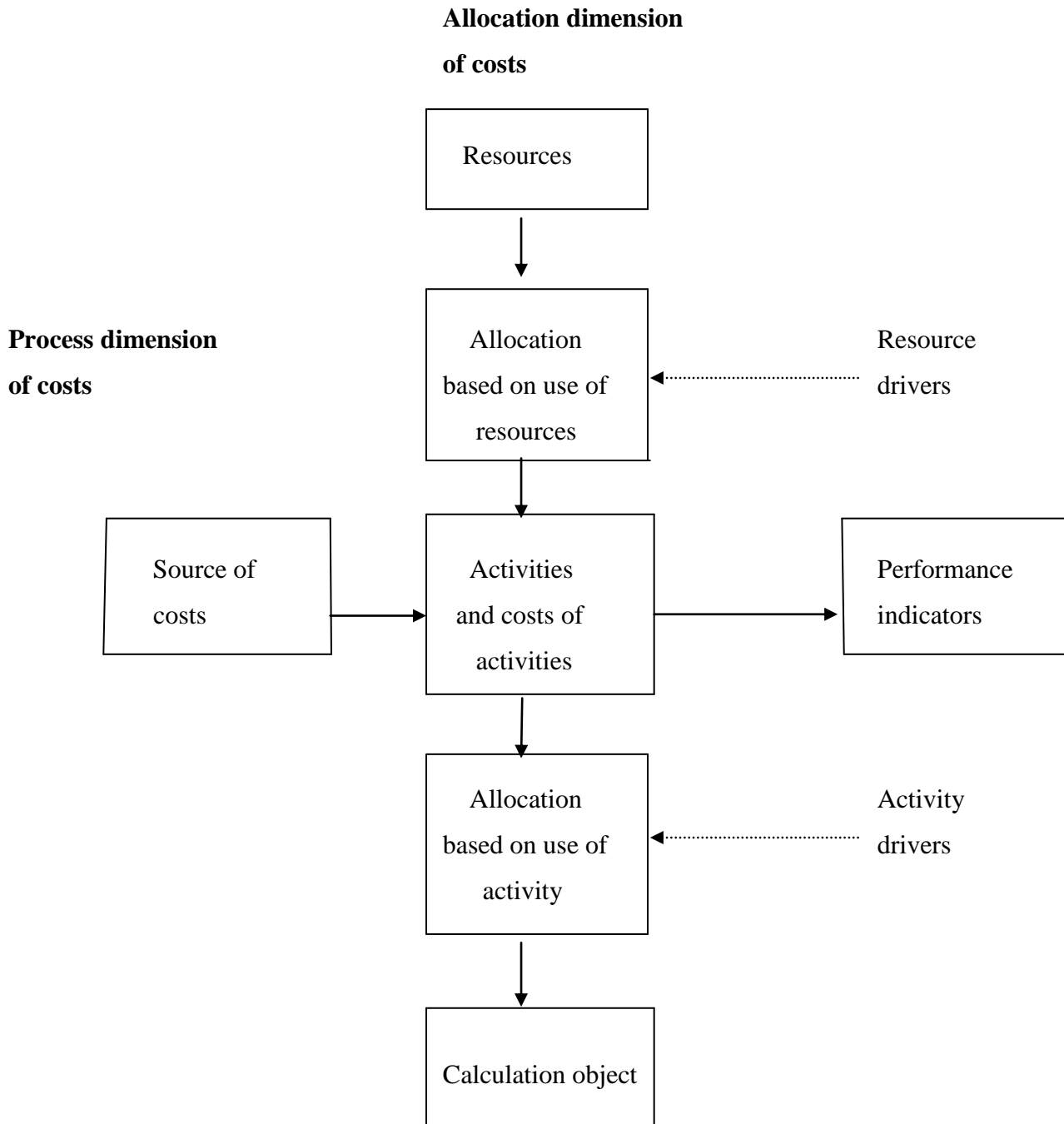


Figure 2. Dimensions of Activity-Based Costing (Vehmanen 1997, 130)

The meaning of process dimension of costs is to find out how much activities use resources. In process dimension of costs activities are in spotlight contrary to allocation dimension to costs were calculation object are in spotlight. The meaning of

process dimension of costs is to find out how work related to activity is done and how it is related to other activities. The concept of activity chain is behind this view. The meaning of process dimension of costs is continuous improvement production process. (Vehmanen 1997, 146-148.)

2.4 Dividing expenses in Activity-Based Costing

The principle of dividing expenses in Activity-Based Costing is that all expenses will be divided based of matching principle. In manufacturing companies over capacity and unused capacity costs will not be divided because it would create unfair costs to products and create price pressures to finish products. Products development costs will not be divided because they are profiting new products (Alhola 2000, 44). In service companies, due to the fact that it is difficult to estimate demand for certain activities and resources, customers are carrying unused capacity costs. Since services are customer-specific, it is hard to standardize resources and supply them in advance. There are customers that are unpredictable and that constantly change volumes and timings of orders. These customers must realize that they are causing unused capacity and unnecessary costs to service companies. These costs are paid by customers in service companies. (Kaplan & Cooper 1998.)

2.4.1 Identify activities

In Activity-Based Costing companies appear as set of activities. Every performed task within company can be named as an activity. Activities vary from company to company since the companies are different, for example activities of manufacturing firms will differ from activities of service firms. Activities that require less than five percent of a resource capacity or employee's time should not be included as activities. When observing service firms and identifying activities it is important to notice that a company can determine and control internal activities, but it is the customer who almost completely determines the demand for activities. (Kaplan & Cooper 1998.)

Hierarchies of activities must be recognized and refined before calculating of expenses of activities is possible (see Figure 3 below). The hierarchy gives managers a

structured way of thinking. Revealing relationships between activities and resources is a key to successful cost accounting. (Cooper & Kaplan 1991, 131.)

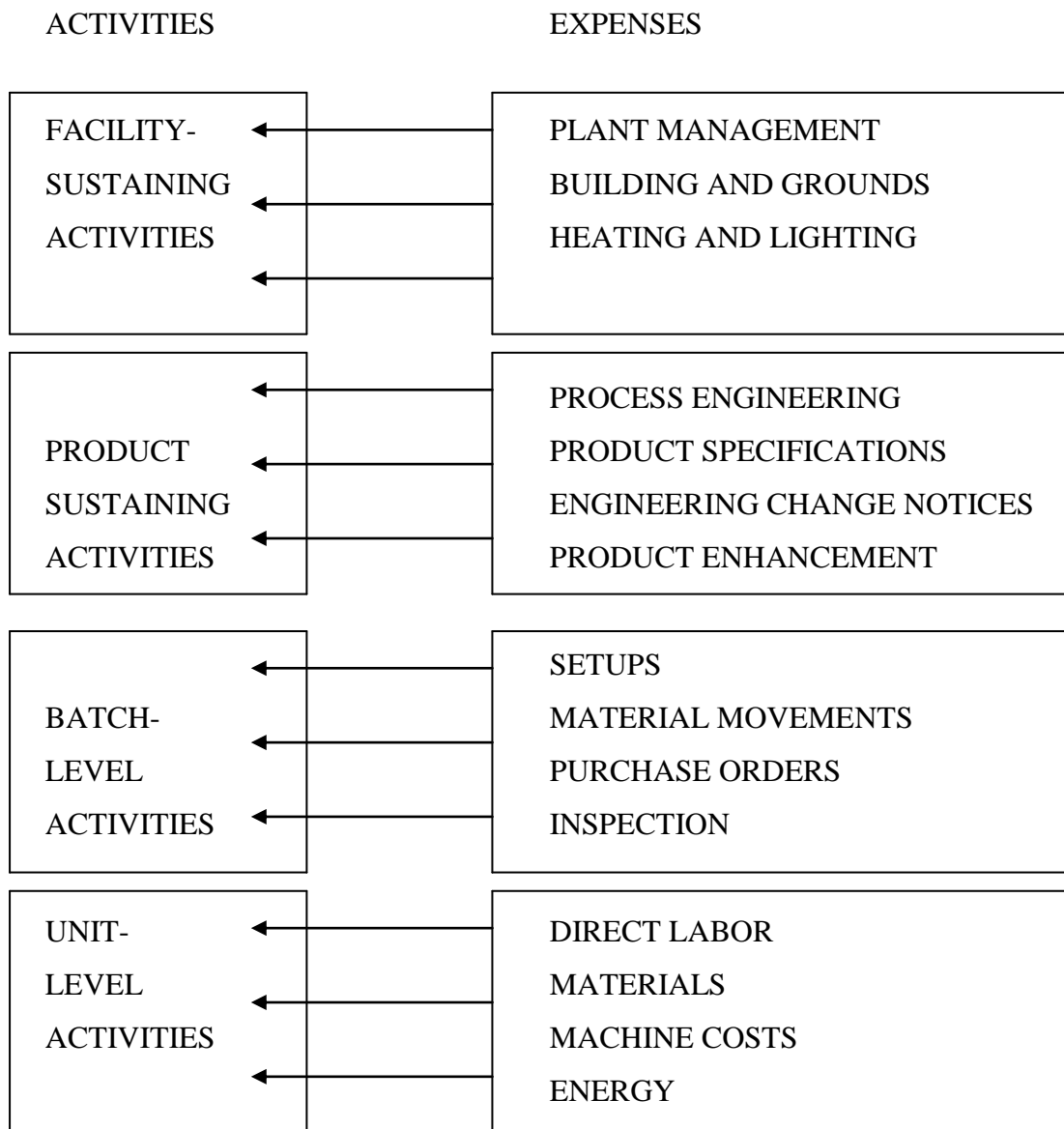


Figure 3. The Hierarchy of Expenses (Cooper & Kaplan 1991, 132)

Expenses of facility sustaining activities enable entrepreneurship. These expenses are not related to production volumes and they will be vanished when company will be close down. Expenses of product sustaining activities may be related to number of products produced. These expenses normally increase when products became more complex and number of different articles produced increases.

Expenses of batch level activities will arise from number of setups, inspections, material movements and purchase orders. These expenses will emerge only when batch will be produced and they are not related to number of items produced. Expenses of unit level activities are dependent from production volumes and they will be distributed directly to products. Direct labor and material are typical representatives on unit level expenses. (Cooper & Kaplan 1991, 130-135.)

2.4.2 Reveal costs of activities

Costs of resources consumed over a period are assigned to every activity through cost centers / cost pools to determine why the costs occurred. Cost pools are groups of activities, which spend resources in the same way and are related to each other. Cost pools are not necessarily to use in Activity-Based Costing. Cost centers are groups of activities, which help to control activities and processes. All customer center cost of a company can be formed under one activity, which with create a cost center. (Alhola 2000, 54.)

Typically historical expenses from the most recent period are used when costs are revealed first time to activities. Results of Activity-Based Costing are easier to understand and more acceptable when historical expenses are used. Budgeted numbers can be also used. This is relevant when historical expenses are deceptive or company has changed its business plan or business activities. Expenses are taken from the financial statement of a company if there is no reason for using budgeted numbers. Expenses can be assigned directly to activities if matching principle is unequivocal and clear. Expenses, which are not possible to assign directly to activities, must be analysed. The purpose of these analyses is to reveal what share of specific expense is created by certain activity. Time consumption of personnel needs to be analysed in most of cases and the first level cost drivers must be identified before costs of activities are revealed. (Lumijärvi et al 1995, 66-68.)

2.4.3 Identify cost drivers

In Activity-Based Costing cost drivers have two different definitions. According to the first definition, a cost driver is a factor which is used for dividing expenses to

activities. These are first level cost drivers which are called also as resource drivers. According to the second definition, a cost driver is a quantitative measure of the output from the company's activities. These are second level cost drivers which are also called as activity drivers. Activity drivers are used to divide activity costs between cost objects such as product, customer and service or market area (Lumijärvi et al 1995, 52-53). The difference between first and second level cost drivers are presented in Figure 4.

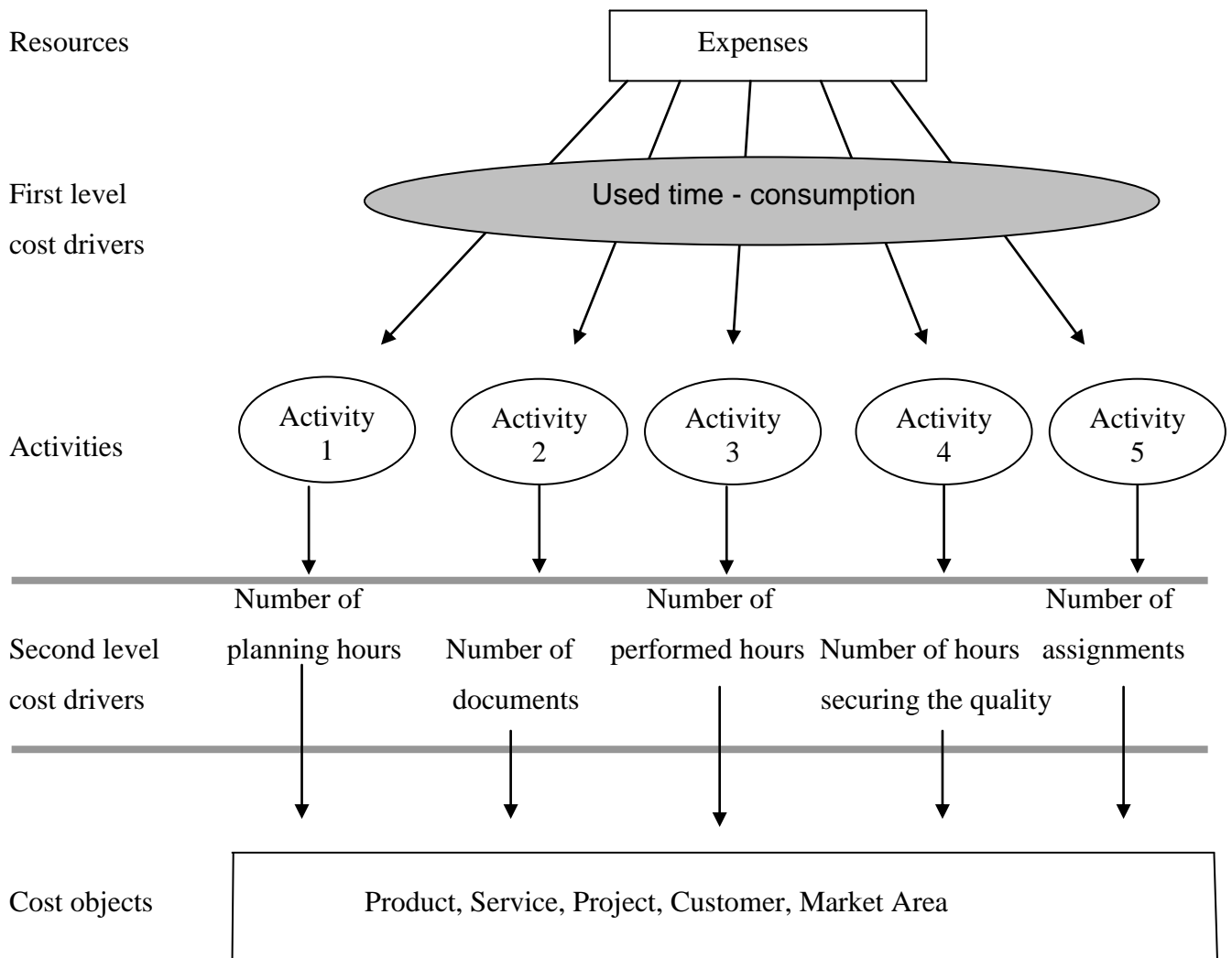


Figure 4. Model of Activity-Based Costing (Lumijärvi et al 1995, 53)

Cost drivers need to be established for each activity. A good cost driver is easy to measure, easy to find and it must be identifiable with the products. Cost drivers vary between companies and they can be also categorized. According to Kaplan and

Cooper different types of cost drivers are transaction drivers, duration drivers, intensity drivers and process drivers. Transaction drivers count the number of times you perform an activity. Duration drivers are the amount of time required to perform an activity. Intensity drivers directly charge for the resources used every time you perform an activity. Process drivers look at the efficiency of doing an activity. (Kaplan & Cooper 1998.)

2.4.4. Assign costs to cost objects

Total costs of an activity are divided to costs objects with activity drivers (see Figure 5 below). Cost object has been traditionally product but it can be also project, service, market area or customer. (Lumijärvi et al 1995.)

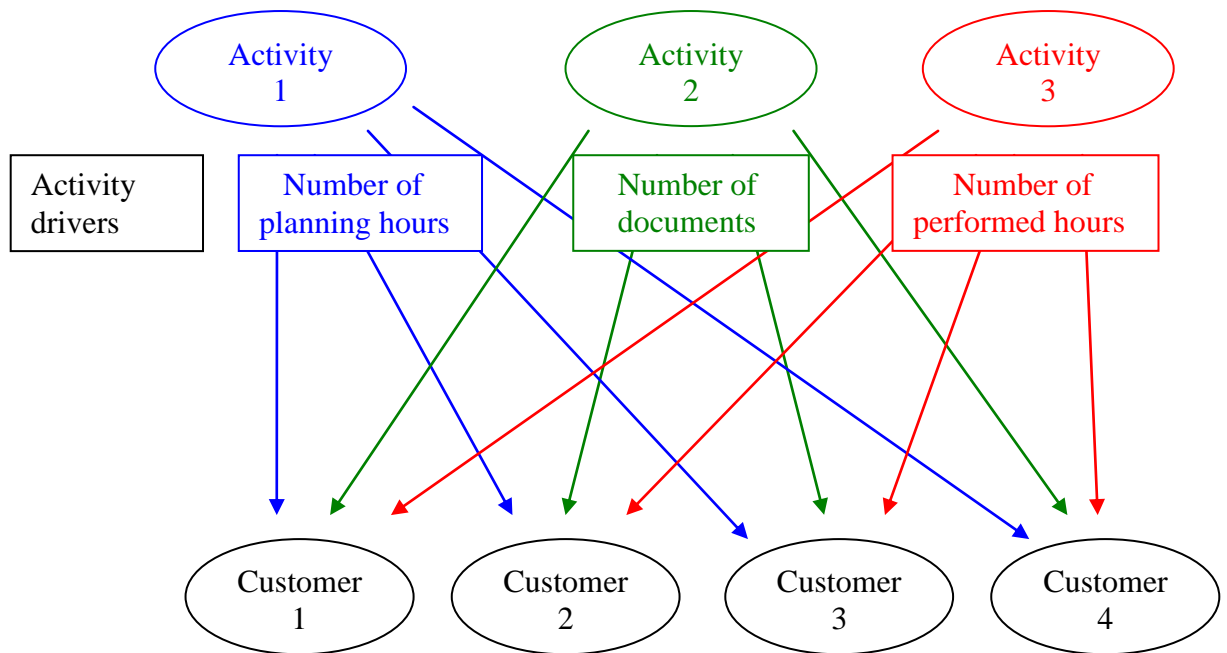


Figure 5. Assigning costs from activities to customers

Deciding of activity drivers is a critical point in Activity-Based Costing. Incorrect and inaccurate activity drivers will lead to false and useless results. Also activity drivers which are hard to understand will question the results calculations. Deciding of activity drivers is a clear action. You just need to know what causes the action and why the action is done. (Lumijärvi et al 1995, 57-58.)

3. DFDS LOGISTICS AND DFDS A/S

DFDS Logistics is a logistics division of DFDS A/S. DFDS Logistics is a name for land-based transport activities. Brand name DFDS Logistics was taken in use in July 2010. New brand will replace the current trailer business brands such as Halléns, Speedcargo and Norfolkline. (DFDS Update.)

3.1. Halléns

Halléns was founded by Gösta Hallen in Gothenburg Sweden in 1965. The company started operating as Gösta Halléns Åkeri. Halléns Transport AB was reorganized in 1983. Halléns N.V. was founded in Gent Belgium in 1984 (Halléns Transport AB - Företaget). Both companies Halléns Transport AB in Sweden and Halléns N.V in Belgium started as family-run companies. A separate representative office Halléns France SA was opened in Paris France in 1992. Halléns Oy in Finland was established in 1999. In May 2005 Halléns Oy moved from Kotka to Port of Hamina. In August 2005 Danish shipping company DFDS A/S acquired 66-percent of Halléns N.V. shares (Halléns nv). In 2008 DFDS A/S increased ownership in Halléns N.V. to 80-percent. Halléns Oy and Halléns France SA are 100-percent owned by Halléns N.V. (Frontpage - DFDS). In 2009 DFDS A/S acquired remaining shares of Halléns N.V. and increased their ownership to 100-percent. (Annual Report of DFDS A/S 2009.)

Today Halléns is a Belgium trailer operator. Company is specialized in one geographical axis. This north-south concept of combined road-ferry-road transport will connect northern parts of Norway to southern parts of Spain. Main cargo loads of Halléns are carried from Belgium and northern part of France to southern parts Finland, Sweden and Norway. Halléns operates with more than 1,000 trailers between Scandinavia and the Continent. Yearly company will carry more than 35 thousand full trailer loads between Scandinavia and the Continent. The Biggest cargo flows are on DFDS' EuroBridge between Gent Belgium and Gothenburg Sweden. (Halléns nv.)

Halléns has offices in Hamina Finland, Gothenburg Sweden, Gent Belgium and Paris France (Halléns nv). In Sweden trailer services of Halléns were integrated with Speedcargo AB in October 2006 (SpeedCargo). Halléns France SA is mainly a sales

office. Headquarter of Halléns Group is located in Gent Belgium. Administrative and strategic business decisions are made in Gent office. Office in Finland is specialized in operative decisions as well as sales.

In Finland Halléns operates mostly with full trailer load from Finland to France and vice versa. Other possible destinations on the Continent are The Netherlands, Belgium, Luxemburg, Germany and Spain. In 2008 Halléns carried more than five thousand full trailer loads between Finland and the Continent. In 2009 numbers of carried full trailer loads decreased to four and half thousand loads. Ports which are used within this axis (Finland – Belgium) are Port of Hamina, Port of Rauma, Port of Kotka, Port of Helsinki and Port of Hanko in Finland and Port of Antwerp and Port of Zeebrugge in Belgium. Sometimes also ports of Germany are used. Halléns is also chartering cargoes to smaller companies which do direct loads from Finland to France. Halléns N.V. was renamed to DFDS Logistics N.V. in October 2010 and Halléns Oy will be renamed to DFDS Logistics Oy.

3.2 Speedcargo

DFDS A/S owns also other transport companies than Halléns. One of DFDS A/S's companies is Speedcargo. Speedcargo is relatively young company. Speedcargo was established in March 2006 as a result of a merger of Hecksher Transport AB and Speedcargo (Sweden) AB. Both of these companies were part of DFDS A/S when merger happened. Nowadays Speedcargo AB is 100-percent own by DFDS A/S. Hecksher Transport was part of P&O Ferrymasters. Hecksher Transport started operating in 1964 between United Kingdom and Scandinavia. Speedcargo started operating at same United Kingdom and Scandinavia route in 1984. (SpeedCargo.)

Speedcargo is one of the biggest trailer transport companies between United Kingdom / Ireland and the Scandinavian. Speedcargo operates with approx. 2,000 trailers and they have several offices around the North Sea. In Sweden Halléns and Speedcargo have been operating under same roof since October 2006. (SpeedCargo.)

3.3 Norfolkline

Norfolkline was founded in 1961 as a logistics company in The Netherlands. Norfolkline entered into Ro-Ro shipping business in 1969. In December 2009 DFDS entered into conditional agreement to acquire Norfolkline from A. P. Møller – Mærsk A/S. Acquisition was completed in July 2010 after approval of competition authorities. As a part of the acquisition A. P. Møller – Mærsk A/S became the second biggest shareholder of DFDS A/S with 31-percent of shares. (Frontpage – DFDS.)

Norfolkline is a ferry and logistics company with a ferry route network covering the North Sea, the English Channel and the Irish Sea. Norfolkline provides logistics services across Europe. In Finland Norfolkline have two-person office in Helsinki. Norfolkline Finland has concentrated in combined transport from Finland to Italy and vice versa. Despite of this concentration Norfolkline provides logistics services are also to Denmark, Sweden, Norway, The United Kingdom and Ireland. (Norfolkline.)

Norfolkline had revenue of 600 million euros in 2009 and they employed 2,200 persons. Land personnel were working in 28 logistics sales offices, eight warehouses and five port terminals. Vessel crews were on board of 18 vessels which sailed on 10 routes on the North Sea, the English Channel and the Irish Sea. (Norfolkline.)

3.4 DFDS A/S

DFDS A/S is a leading North European liner shipping company and shareholder of Halléns N.V. DFDS - "Det Forenede Dampskibs- Selskab" was founded in 1866 in Denmark. From the beginning DFDS has been involved in domestic as well as international trade, transporting both freight and passengers. International activities started in the North Sea and in the Baltic Sea. International operations in the Mediterranean Sea followed and at the end of 19th century routes to the United States and South America were also established. In 1933 DFSD owned 123 ships. In 1951 number of motor ships exceeded the number of steamships for the first time. (DFDS 2006, 98-166.)

In 1977 DFDS A/S established DFDS Transport. DFDS Transport opens office in Finland at 1989. In 1999 DFDS acquired Dan Transport and merged DFDS Transport and Dan Transport to DFDS Dan Transport. DFDS Dan Transport was the second biggest transport company in the Nordic Region and one of the ten biggest transport companies in Europe. In 2000 DFDS sold DFDS Dan Transport to DSV. Number of DFDS employees falls overnight by 8,500. Number of employees decreased from 12,000 to 3,500. (DFDS 2006, 98-166.)

Strategy of DFDS changed from a global land-and sea-based transport and passenger company into a shipping company. DFDS had two business areas, Ro-Ro liner traffic and passenger shipping. In 2005 DFDS started acquiring transport companies again. Danish HSL Trading A/S, including two Swedish trailers operators Hecksher Transport Ab and Speedcargo Ab were acquired by DFDS. In 2005 DFDS acquired LHT Transport (Holding) B.V. from the Netherlands and 66-percent from Halléns N.V. in Gent Belgium (DFDS 2006, 98-166). Since 2005 DFDS has continued acquisitions by acquiring Norfolkline from A. P. Møller – Mærsk A/S in December 2009. DFDS had five business areas Ro-Ro shipping, container shipping, passenger shipping, terminal services and trailer services in 2009. (Frontpage – DFDS.)

In 2009 DFDS A/S freight activities were handled by DFDS Tor Line and passenger activities were handled by DFDS Seaways. DFDS Tor Line operated with 54 freight vessels mainly at North Sea, but also in the Baltic Sea. In overall DFDS Group operated with 60 vessels in 13 countries. The group employed approx. 4,300 employees at 2009 (Frontpage - DFDS, 11.01.2010). After combining Norfolkline to DFDS, revenue of DFDS will be approx. 1,480 million euros. Number of employees increased to 6,200. Land personnel are working in 41 logistics sales offices, 13 port terminals and eight warehouses. DFDS operates 63 vessels on 32 different routes on the Baltic Sea, the North Sea, the English Channel and the Irish Sea. (Frontpage – DFDS.)

DFDS A/S is listed on the Copenhagen Stock Exchange. Main shareholder of DFDS A/S is Vesterhavet A/S. Vesterhavet A/S owns 36.0-percent of the shares. Second largest shareholder is A. P. Møller – Mærsk A/S. A. P. Møller – Mærsk A/S owns

31.3-percent of the shares. Third largest ownership is handled by Clipper Group A/S with 9.2-percent of the shares. (Frontpage – DFDS.)

4. PORTS OF FINLAND

Finland has 68 ports for foreign traffic (Merenkulkulaitos 2004). In 2009 shipments to foreign destinations were carried out from 52 ports (Port of Helsinki). Most of the ports of Finland are small. Port is defined as small if less than 400 vessels visited the port during the year 2009 and total tons of imports and exports were less than one million tons. In 24 ports number of vessels visited is greater than 400 or total of imports and exports is greater than one million tons. (Merenkulkulaitos 2004.)

In 2009 largest foreign traffic port according to total tons was Port of Sköldvik with 15.56 million tons. Port of Sköldvik is a liquid bulk port. The second largest port is Port of Helsinki and the third largest port is Port of Kotka. Port of Naantali is fourth largest port according to total tons. Total tons of Port of Naantali consists mainly from liquid and dry bulk. Fifth largest port is Port of Rauma (Finnish Port Association). Ten largest ports in Finland carried out 78-percent of all foreign cargo traffic in 2009. (Port of Helsinki.)

4.1 Port of Hamina

Port of Hamina is located 35 kilometers from Russian border. Port is the easternmost port in Finland. Port serves specially transit traffic to Russia and CIS countries, container and liquid companies for storage and liquid companies for handling of liquids (Port of Hamina). Port of Hamina is the second largest port in Finland by land area of 461 ha. Port has a storage area of 384 000 square meters in warehouses, which is the second largest area in Finnish ports. Seven Ro-Ro ramps are available to serve shipping companies and quay length of Port of Hamina is 2,978 meters. (Finnish Port Association.)

Turnover of Port of Hamina was 10.41 million euros in 2009 and they employed 35 persons. Turnover decreased by 7.4-percent from year 2008. Turnover was 11.24

million euros in 2008. Port of Hamina had total of imports and exports 2.91 million tons in 2009. In 2008 total of imports and exports was 3.81 million tons and in 2007 total of imports and exports was 4.78 million tons. (Finnish Port Association.)

4.2 Port of Hanko

Port of Hanko is the southernmost port in Finland. Port of Hanko is specialized in paper exports and car imports. There are two ports in Hanko, Western Harbour and Outer Harbour. Ports are located near each other. Western Harbour is the main port in Hanko and Outer Harbour is mainly used for car imports. (Port of Hanko ~ Hangon Satama) Port of Hanko has a land area of 141 ha. Port has a storage area of 56 800 square meters in warehouses. Seven Ro-Ro ramps are available to serve shipping companies and quay length of Port of Hanko is 1,800 meters.

Port of Hanko had imports and exports together 2.42 million tons in 2009. In 2008 total of imports and exports was 3.59 million tons and in 2007 total of imports and exports was 2.96 million tons. (Finnish Port Association.)

4.3 Port of Helsinki

Port of Helsinki is the most important general-purpose port in Finland and the busiest passenger port in Finland. In 2009 9.01 million passengers passed through Port of Helsinki. Main cargo port operations are in Vuosaari Harbour, which was opened in November 2008. Vuosaari is located on the eastside of city of Helsinki. Turnover of Port of Helsinki was 81.4 million euros in 2009. Turnover decreased by 14.9-percent from year 2008. Turnover was 95.4 million euros in 2008 (Port of Helsinki). Port of Helsinki has a land area of 302 ha. Port has no storage area in warehouses next to quays. In total 31 Ro-Ro ramps are available to serve shipping companies and quay length of Port of Helsinki is 11,046 meters. (Finnish Port Association.)

Port of Helsinki had imports and exports together 9.70 million tons in 2009. In 2008 total of imports and exports was 11.68 million tons and in 2007 total of imports and exports was 13.07 million tons (Finnish Port Association). During the year 2009 432 thousand trucks, trailers or comparable transport equipment were transported via Port

of Helsinki. Ports share in rubber-wheeled traffics equals with 55-percent of all traffic in Finland. (Port of Helsinki.)

4.4 Port of Kotka

Port of Kotka is the biggest port in Finland by land area. Total port area is 629 ha. Port of Kotka contains three ports. Ports are City terminal, Hietanen and Mussalo. City terminal is the oldest part of Port of Kotka. Hietanen was opened in 1971 and it's specialized in Ro-Ro traffic and cars. Mussalo is the newest and by far the largest part of Port of Kotka. Mussalo includes bulk, liquid and container terminals. Mussalo is the largest container port in Finland (Kotkan Satama Oy – Port of Kotka). Port has a storage area of 541 000 square meters in warehouses, which is by far the largest area in Finland. 11 Ro-Ro ramps are available to serve shipping companies and quay length of Port of Kotka is 5,347 meters. (Finnish Port Association.)

Port of Kotka had imports and exports together 7.26 million tons in 2009. In 2008 total of imports and exports was 11.34 million tons and in 2007 total of imports and exports was 10.28 million tons. (Finnish Port Association.)

4.5 Port of Naantali

Port of Naantali is third largest port in Finland by total tons. Main volumes are generated by liquid and dry bulk. Port of Naantali is mainly hub for bulk goods operations. Port of Naantali offer regular Ro-Ro traffic to Kapellskär Sweden. Half of seaborne lorry transportations by ferries between Finland and Scandinavian are transported via Port of Naantali (Naantali : General). Port of Naantali has a land area of 24 ha. Port has a storage area of 5 723 square meters in warehouses. Three Ro-Ro ramps are available to serve shipping companies and quay length of Port of Naantali is 1,282 meters. (Finnish Port Association.)

Port of Naantali had imports and exports together 5.69 million tons in 2009. In 2008 total of imports and exports was 7.01 million tons and in 2007 total of imports and exports was 6.84 million tons. (Finnish Port Association.)

4.6 Port of Rauma

Port of Rauma is the largest port on Finnish west coast. Port is owned by city of Rauma and port operations are organized by Oy Rauman Satama Ltd. In 2008 turnover of Port of Rauma was 15.88 million euros and they directly employed 52 persons. In 2009 turnover of Port of Rauma decreased to 13.43 million euros and personnel decreased to 50 persons. Ro-Ro traffic in Port of Rauma is concentrated to Hakuni Harbour part and Ro-Ro traffic is operated by Oy Rauma Stevedoring Ltd (Rauman Satama | Port of Rauma). Port of Rauma has a land area of 115 ha. Port has a storage area of 275 000 square meters in warehouses. Seven Ro-Ro ramps are available to serve shipping companies and quay length of Port of Rauma is 3,233 meters. Port of Rauma had imports and exports together 4.97 million tons in 2009. In 2008 total of imports and exports was 7.10 million tons and in 2007 total of imports and exports was 5.67 million tons. (Finnish Port Association.)

4.7 Port of Turku

Port of Turku is the second biggest passenger port in Finland. In 2009 3.61 million passengers passed through Port of Turku. Turnover of Port of Turku in 2009 was 22.9 million euros and they employed 122 persons on average during the year. Turnover decreased by 4.9-percent from year 2008. In 2008 turnover of Port of Turku was 24.1 million euros (Port of Turku – Annual Report 2009). Port of Turku has a land area of 225 ha. Port has a storage area of 244 400 square meters in warehouses. 13 Ro-Ro ramps and 5,000 quay meters are available to serve shipping companies. (Finnish Port Association.)

Port of Turku had imports and exports together 2.76 million tons in 2009. In 2008 total of imports and exports was 3.19 million tons and in 2007 total of imports and exports was 3.64 million tons (Finnish Port Association). Ro-Ro traffic represents a share of 22-percent of total tons. Port of Turku is the only train ferry port in Finland and train ferry operations represents a share of 17-percent of total tons in 2009. (Port of Turku, Annual Report 2009.)

5. ACTIVITY-BASED COSTING AT DFDS LOGISTICS

In Finland DFDS Logistics is a service company which sells international trailer transport services to other companies. Main customers are Nordic forest companies, global chemical and plastics industry companies and automotive industry. DFDS Logistics does not have trucks of its own in Finland but trailers are owned or rented by DFDS Logistics. Trucking services are bought from Oy TransPeltola Ltd, Pasi Trans Oy and Koskinen-yhtiöt. TransPeltola and Pasi Trans will mainly handle traffic which is operated via Port of Hamina. Koskinen-yhtiöt is handling most of the traffic via Port of Rauma.

5.1 Identifying activities

Activity-Based Costing will start by identifying activities. Activities vary from company to company. Activities at DFDS Logistics are:

1. Receiving booking from customer

Customers book transportations with different ways. Customers send emails, call or send faxes to book transportations. With some long term customers DFDS Logistics uses xml-messages for booking. Some of these bookings are forwarded to Belgium office or received from Belgium office. Part of the bookings has been subcontracted to other transport companies.

2. Transport planning

Transport planning consists of a combining of unloading and loading so that empty kilometers should be minimum between unloading and loading places. It also consists of information send to unloading places when cargo is arriving to them. Agreements with consignees are concluded individually depending of procedure agreed with unloading place. Some customers require exact unloading times which need to be respected. In case times are not respected waiting times can be very long. Some customers are really flexible and it makes transport planning easier for planners.

Transport planning also consists of timetable planning. Loading places can have exact loading times which need to be respected. Transport planning should minimize empty kilometers to minimum and same time requests of customers should be respected. In some cases trailers return empty back to garage or trailers leave empty to loading places.

3. Loading

Loading of a trailer varies according to the loading place. Loading depends on what kind cargo will be carried and what kind of loading equipment is used by shipper. Trailers can be loaded via back, side or roof. Normally trailer is loaded by sender and the driver will assist during loading. The driver lashes cargo and close tarpaulins of trailer. Trailers are not equipped with forklift or pallet truck so loading place need to have loading equipments. Papers for cargo are drafted by shipper.

4. Road transportation

Road transportation means simple transportation on road from loading place to port. Truck and driver are needed for road transportation.

5. Delivering loaded trailer to port

Procedures in ports will differ slightly from port to port. Typically a driver needs to register the trailer into port. The trailer can be registered automatically with cameras or the driver needs to return terminal advice to stevedoring company. Procedures in ports also differ by shipping company used for shipments. Port fees also vary. Terminal advices should be sent to stevedoring companies in advance and shipping companies need to be informed about trailers which will be shipped.

6. Sea voyage

Sea voyage is a fee paid to the shipping company for transportation of a trailer from port to port. Sea voyage is fee from dock to dock, so stevedoring in ports are included in sea voyage price. The shipping company is responsible for shipment of trailer from port to port after the trailer is released to them according to procedures in port.

7. Picking up loaded trailer from port

To be able to pick a trailer up from a port transport company needs typically a release reference. Release reference is quite often a series of numbers. These numbers can be a booking reference of trailer in vessel or they are made up by the stevedoring company. Some ports require terminal advices. Generally procedures differ from port to port. Release fees and fees for terminal advices may also exist.

8. Road transportation

Road transportation means transport on road from port to unloading place. Truck and driver are needed for road transportation.

9. Unloading

Unloading of trailer differs by the unloading place. Unloading of trailer depends on what kind cargo will be delivered and what kind of unloading equipment can be used at unloading place. Trailers can be unloaded via back, side or roof. Driver will open the tarpaulins of trailer or back doors as well as opening the lashing bands. Unloading place is in charge of unloading the cargo at unloading place and unloading is done by their personnel.

10. Invoicing, customer service and administration

Invoicing of transportation normally takes place after cargo is unloaded to consignee. Sometimes advance payment is required. Some freight payers need to have signed CMR to be attached to the freight invoice. Unfortunately sometimes cargo damages

occur or freight invoices stand outstanding. Customer service is needed in these cases as well as when offers are done for new possible customers or current agreements are updated.

The ten activities above will describe activities of export cargo from Finland for example to Belgium. Activities from number one to number five take place in Finland. Activity number six, sea voyage, will take place in Finland as well as in Belgium. Activities from number seven to number ten take place in Belgium. If these activities describe import to Finland, then activities from one to five are done in Belgium. Activity number six is in both countries and activities from number seven to number ten in Finland. Invoicing in activity number ten is done in Belgium because freight invoices are sent from Belgium. Activity number ten also includes customer service which is done for Finnish customers mainly in Finland. Activities number one and number ten will be done in both countries but only expenses accrued in Finland are part of calculations.

5.2 Resources for activities

DFDS Logistics needs resources for its operations. DFDS Logistics has four employees in office in Hamina. Office space is rented from Port of Hamina Ltd. Resources needed for performing activities are listed on Figure 6.

ACTIVITY	RESOURCES
1. Receiving booking from customer	Employee of DFDS, phone, fax, computer
2. Transport planning	Employee of DFDS, computer, phone, fax
3. Loading	Truck, trailer, forklift, driver
4. Road transportation	Truck, trailer, driver
5. Delivering loaded trailer to port	Truck, trailer, driver, fax, computer, employee of DFDS
6. Sea voyage	Terminal tractor, vessel
7. Picking up loaded trailer from port	Truck, trailer, driver, fax, computer
8. Road transportation	Truck, trailer, driver
9. Unloading	Truck, trailer, forklift, driver
10. Invoicing, customer service & administration	Employee of DFDS, phone, fax, computer

Figure 6. Resources needed for activities

Resources listed in Figure 6 are resources which are needed for performing an activity. All activities are not performed by DFDS Logistics. Some activities are subcontracted from other companies. Expenses of these activities are a part of calculations because activities are needed for performing transportation from Finland to Belgium. Expenses are paid by freight payer and expenses need to be noticed in freight pricing.

Truck and driver is a resource which is subcontracted from other companies. Pricing of this resource is fixed price per kilometer when truck is moving and fixed price per hour when driver is waiting on customer's site. These expenses are part of calculations.

Trailers used by DFDS Logistics are owned or rented but no matter if the trailer is owned or rented, it will create capital costs. These capital costs are not part of calculations because own trailers are owned by DFDS Logistics in Belgium and not DFDS Logistics in Finland. Rented trailers have costs per day or month which is

visible and easy to trace. Owned trailers have capital costs. Trailers need to be repaired, maintained and inspected. All of these create costs and obsolescence is inevitable so new trailers need to be purchased from time to time.

A terminal tractor is a resource of a stevedoring company. Terminal tractor is needed in ports for pushing trailers into vessel or pulling trailers out from vessel. Terminal tractor expenses are part of activity number six because in practice shipping companies sell sea voyages on quay to quay. Vessel is a resource of shipping company. Shipping companies sell lane meters to vessels which are used to carry trailers from port to port.

Communication is in a vital role in successful transportation. Phone, fax and computer are needed for employees for keeping all necessary parties informed. This is needed especially in cases when consignees need to prepare for unloading by renting a forklift. Unloading places need also information so that they can prepare themselves by collection cargoes on forehand.

5.3 Activity chain at DFDS Logistics

Activity chain in Figure 7 is described as perspective of one booking. This perspective is used for settling activities. Activities from number four to number eight are part of transportation in Figure 7.

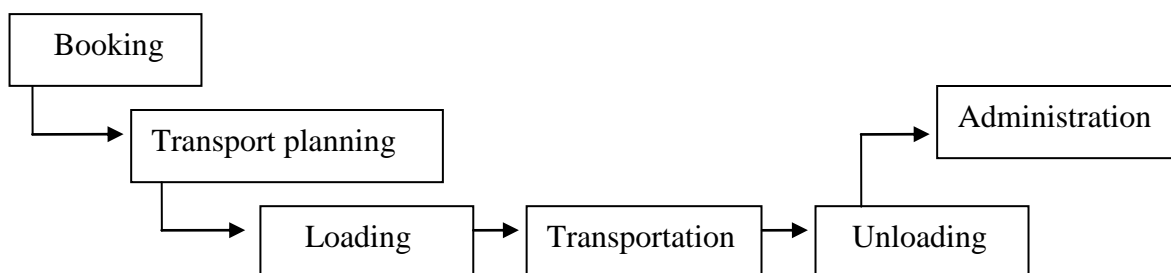


Figure 7. Activity chain at DFDS Logistics - booking perspective

In reality imports and exports are linked to each other and they are done simultaneously. Activity chain can be described also from perspective of trailer visit in Finland (see Figure 8 below).

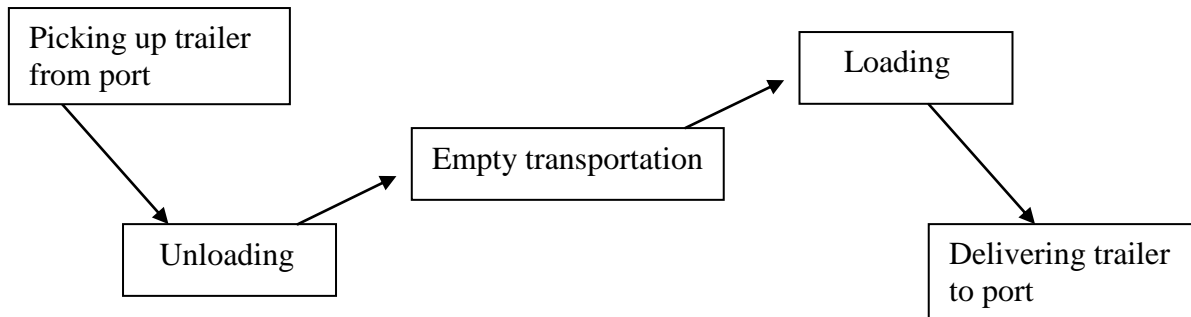


Figure 8. Activity chain at DFDS Logistics - trailer perspective in Finland

Activity chain would start from defined activity number seven if activity chain is seen as perspective of trailer visiting in Finland. Then activities number eight and number nine would follow. When trailer is empty at unloading place, activity number two, transport planning, would play its role and trailer would be driven to loading place, which is activity number three. Then activities number four and number five would follow and trailer would be shipped back to the Continent. The defined activities number six and number one would not be part of this activity chain. Activity number one would not be part of this chain because receiving a booking from customer is not related to trailer.

5.4 Revealing costs of activities

Costs to activities formed based on financial statements of DFDS Logistics Oy from financial year 2009. Expenses by accounts are presented in Figure 9. Some of these expenses are estimations based on monthly costs. Expenses which are not related to operations such as entertainment expenses and concert tickets are not included. These expenses are considered as irrelevant costs and they are not related to operational functions. Account of expenses is on the left side. Amount of expenses on period of a year will follow. The right side of the table will tell the activities by number to whom expenses will be divided.

ACCOUNT	EUROS / YEAR	COST DRIVER	ACTIVITY BY NUMBER
Staff expenses	€ 170 000	Use of resource	1, 2, 5, 10
Office			
- Office rent	€ 18 500	Direct costs	10
- Cleaning & sanitation	€ 2 000	Direct costs	10
- Telephone, fax & data	€ 11 000	Use of resource	1, 2, 5, 10
- Office equipment	€ 5 500	Use of resource	1, 2, 5, 10
- Office machine leasing	€ 2 000	Direct costs	10
Financial Administration	€ 8 500	Direct costs	10
Insurance	€ 1 000	Direct costs	10
TOTAL	€ 218 500		

Figure 9. Expenses by accounts

Total of expenses is 218 500 euros. Majority of expenses of DFDS Logistics is staff expenses. Share of staff expenses is 77.8-percent of total expenses. Office rent will create 8.5-percent of total expenses and telephone, fax & data expenses will create 5.0-percent of total expenses. Financial administration has a share on 3.9-percent of total expenses.

Staff expenses, telephone, fax & data expenses and office equipment expenses are revealed to activities based on use of resource. Other expenses on figure 9 are revealed to activity ten as a direct cost. Revealing of staff expenses is presented in chapter 5.5. Telephone, fax & data expenses and office equipment expenses will be divided between activities as presented in Figure 10.

	Telephone, fax & data expenses		Office equipment expenses	
	1. Receiving booking from customer	20 %	€ 2 200	10 %
2. Transport planning	30 %	€ 3 300	25 %	€ 1 375
5. Delivering loaded trailer to port	20 %	€ 2 200	5 %	€ 275
10. Invoicing, customer service & administration	30 %	€ 3 000	60 %	€ 3 300
TOTAL	100 %	€ 11 000	100 %	€ 5 500

Figure 10. Revealing of expenses to activities

Activity number one has 20-percent share of telephone, fax & data expenses and 10-percent share on office equipment expenses. Percentages are based on daily observations of use of resource in the DFDS Logistics' office. Based on observations activity two has 30-percent share of telephone, fax & data expenses and 25-percent share on office equipment expenses. Activity number five has 20-percent share of telephone, fax & data expenses and 5-percent share on office equipment expenses. Activity number ten has 30-percent share of telephone, fax & data expenses and 60-percent share on office equipment expenses.

5.5 Time used by employees

Employees of DFDS Logistics in Finland are part of activities number one, two, five and ten. Drivers in Finland are working for subcontractors and their work is a part of activities number three, four and five. DFDS Logistics has four employees in Finland. Three of them are mainly working as traffic coordinators and forth one is managing director. Employee expenses are allocated to activities as in Figure 11.

ACTIVITY	PERCENTAGE	EXPENSES IN YEAR
1. Receiving booking from customer	10 %	€ 17 000
2. Transport planning	35 %	€ 59 500
5. Delivering loaded trailer to port	5 %	€ 8 500
10. Invoicing, customer service & administration	50 %	€ 85 000
TOTAL	100 %	€ 170 000

Figure 11. Time used by employees

Total staff expenses in a period of a year are 170 000 euros. Total expenses are divided to activities by percentages. Percentages of activities are results of analyzing activities use of total resource. Percentages represent activities part of total expenses. Salaries of the employees of DFDS Logistics are not the same. This is taken in attention and percentages are adjusted so that expenses in year per activity will be correct.

5.6 Total costs of activities

Total costs of activities are gathered to Figure 12. Activity number ten represents 56.6-percent of total costs of DFDS Logistics. Activity number two represents 29.4-percents on total costs. Activity number one represents 9.0-percent and activity number five 5.0-percent of total costs. Total costs of activities number three and four are investigated case by case because these costs are case sensitive. Costs of activities number six, seven, eight and nine will occur in Belgium so they are not a part of calculations.

ACTIVITY	TOTAL COSTS
1. Receiving booking from customer	€ 19 750
2. Transport planning	€ 64 175
5. Delivering loaded trailer to port	€ 10 975
10. Invoicing, customer service & administration	€ 123 600
TOTAL	€ 218 500

Figure 12. Total costs of activities

Total costs will be divided with activity drivers (see Figure 13 below). After dividing it is possible to know, what the total costs of cost objects are. Activity drivers are number of export bookings and total number of exports and imports. Value of export bookings is 2500. Value of exports and imports total is 4650. Values are close to real values of DFDS logistics operations on year 2009.

ACTIVITY	ACTIVITY DRIVERS	VALUE OF DRIVER
1. Receiving booking from customer	Number of export bookings (year 2009)	2 500
2. Transport planning	Total number of exports and imports (year 2009)	4 650
5. Delivering loaded trailer to port	Number of export bookings (year 2009)	2 500
10. Invoicing, customer service & administration	Total number of exports and imports (year 2009)	4 650

Figure 13. Activity driver and driver values

Value of number of export bookings is used to activities number one and five. This is used for activity number one because all loadings need to be booked. Otherwise no-

one would not know to send a trailer for loading. Activity driver for activity number five is certainly number of export bookings. Value of total number of exports and imports is used to activities number two and ten. Transport planning consist all bookings. Customer service and invoicing is done also for all bookings.

Total costs are divided by activity drivers. This will give as a result of an expense of one action of an activity. Costs of a one activity are in Figure 14.

ACTIVITY	TOTAL COSTS	VALUE OF ACTIVITY DRIVER	EXPENSE TO COSTS OBJECT
1. Receiving booking from customer	€ 19 750	2 500	€ 7.90
2. Transport planning	€ 64 175	4 650	€ 13.80
5. Delivering loaded trailer to port	€ 10 975	2 500	€ 4.39
10. Invoicing, customer service & administration	€ 123 600	4 650	€ 26.58

Figure 14. Costs of one action of activity

When DFDS Logistics receive a booking from customer it will create costs of 7.90 euros. Transport planning will create cost of 13.80 euros per loaded trailer. Customer service and administration of one booking will cost 26.58 euros per trailer in Finland. Delivering loaded trailer to port will cost 4.39 euros as DFDS Logistics' activity costs. Terminal registration fee and cargo charges will be added to activity number five. These costs will be revealed in results of calculations.

6. RESULTS OF ACTIVITY-BASED COSTING

Activity-Based Costing includes three different loading places in Finland. Loading places are Jyväskylä, Lahti and Tampere. Locations of loading places are presented in a map in appendix 1.

Costs are calculated to seven ports in Finland. Locations of ports are presented also in a map in appendix 1. Only costs which occur in Finland are part of the calculations. Calculations are done with three different prices per kilometer. Prices are 0.90 euros, 0.95 euros and 1.00 euros per kilometer. Kilometers from loading places to ports are on Figure 15.

Port \ Loading place	Jyväskylä	Lahti	Tampere
Port of Hamina	241 km	116 km	242 km
Port of Kotka	243 km	118 km	244 km
Port of Helsinki	264 km	98 km	186 km
Port of Hanko	371 km	216 km	232 km
Port of Turku	310 km	217 km	165 km
Port of Naantali	313 km	229 km	173 km
Port of Rauma	297 km	276 km	146 km

Figure 15. Kilometers between loading places and ports

Ports and stevedoring companies charge fees from transport companies. These fees have cost effect to activities number four and five. Stevedoring companies can charge terminal registrations fees. Ports charge cargo fees and storage fees. Cargo fees are charged based on cubic meters or tons. Storage fees at open area are free of charge few days after trailers arrival to port. Values of all of these fees are presented in appendix 2.

Costs of activity number three are dependent from time spent at loading place. Charge used in calculations is 45 euros per hour. Time spent at loading place and charge per hour has effect to total costs but does not have effect to superiority order of ports.

6.1 Loading from Jyväskylä

Activity-Based Costing for loading from Jyväskylä is calculated for 24 tons of sawn goods. 24 tons of sawn goods take 48 cubic meters in a trailer. Loading takes in one hour and 15 minutes. Kilometers from Jyväskylä to ports are in figure 15. Calculations with different kilometer prices are in appendix 3, 4 and 5.

According to calculations, the superiority order of costs is the same with all kilometer prices. Port of Hamina has an advantage followed by Port of Kotka and Port of Helsinki. Port of Hanko is the most expensive one with all calculated kilometer prices. Port of Hanko has also the longest distance to Jyväskylä when Port of Hamina has the shortest distance to Jyväskylä. The order of superiority depends on number of kilometers between Jyväskylä and ports.

The difference in total costs between the cheapest port and the most expensive port goes wider when kilometer price goes up. This is true between all ports when loading is from Jyväskylä and other circumstances are as described above.

6.2 Loading from Lahti

Activity-Based Costing for loading from Lahti is calculated for 22.5 tons of sawn goods. 22.5 tons of sawn goods take 43 cubic meters in trailer. Loading takes in 45 minutes. Kilometers from Lahti to ports are on figure 15. Calculations with different kilometer prices are in appendix 6, 7 and 8.

According to calculations Port of Hamina has an advantage also from Lahti with all kilometer prices. Port of Turku is the fourth, Port of Hanko is the fifth, Port of Naantali is the sixth and Port of Rauma is the seventh with all kilometer prices. Port of Kotka and Port of Helsinki race for second place. Port of Kotka is the second when kilometer price is 0.90 euros per kilometer but Port of Helsinki will take the second place when kilometer price is 0.95 or 1.00 euros per kilometer. Port of Helsinki has 20 kilometer advantage in distance compared to Port of Kotka but more expensive cargo fees will drop Port of Helsinki to third place when kilometer price is 0.90 euros per

kilometer. Port of Hamina has an advantage in cargo fees compared to Port of Kotka or Port of Helsinki.

According to kilometers Port of Helsinki has shortest distance to Lahti. Port of Hamina has the second shortest distance and Port of Kotka has the third shortest distance to Lahti.

6.3. Loading from Tampere

Activity-Based Costing for loading from Tampere is calculated for 24 tons of engines. Loading takes in one hour and 15 minutes. Kilometers from Tampere to ports are on figure 15. Calculations with different kilometer prices are in appendices 9, 10 and 11.

According to calculations, the superiority order of costs is the same with all kilometer prices. Port of Rauma has an advantage followed by Port of Turku and Port of Naantali. Port of Kotka is the most expensive with all calculated kilometer prices. Port of Kotka has also the longest distance to Tampere when Port of Rauma has the shortest distance to Tampere. Order of superiority goes along with number of kilometers between Tampere and ports.

6.4 Conclusion of results

As a conclusion of the analysis of these three loading places it can be said that distance between loading place and port strongly determine total costs in Finland. Road transportation's share of total costs in Finland is on the lowest level in 39-percent with kilometer price of 0.90 euros per kilometer but on the highest level with kilometer price of 1.00 euros per kilometer it is in 72 percent. If distance from loading place to port is longer than used in these calculations, road transportations share of total costs will be greater than 72-percent. Therefore the closest ports should be used for shipments if there is a possibility to use closest port for shipment from Finland to specified ports on the Continent and sea freight is at same level between ports.

Road transportations share of total costs is illustrated in Figure 16 with kilometer price of 0.95 euros per kilometer. It can be seen that trucking costs in Finland determine highly total costs in Finland.

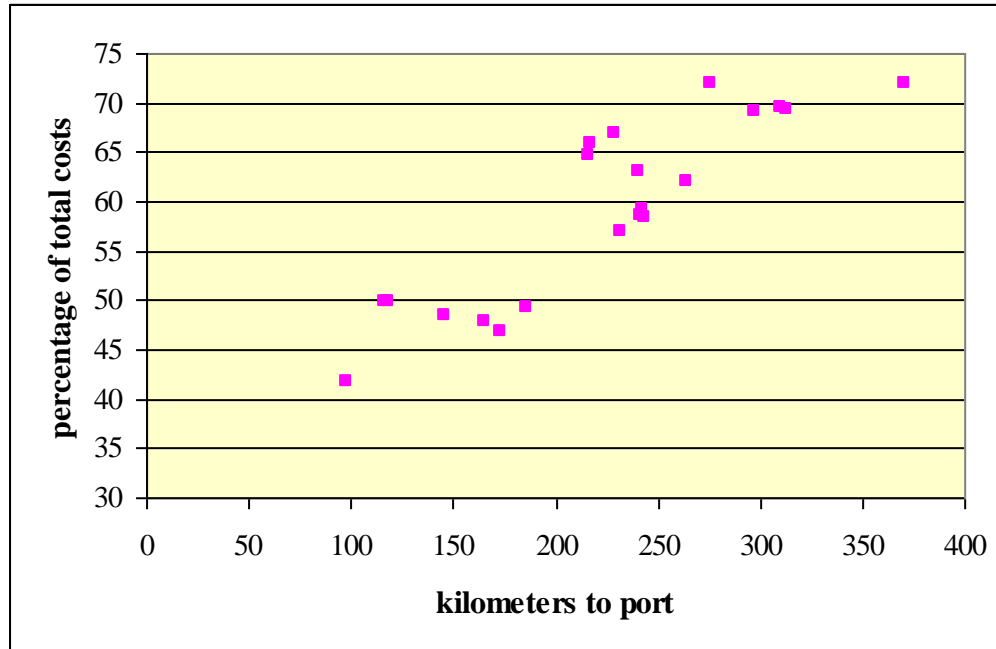


Figure 16. Dependence between kilometers to port and road transportations share of total costs in Finland

Ideal mix for these loading places would be that loading in Lahti and loading in Jyväskylä will be shipped via Port of Hamina. Loading in Tampere would be shipped via Port of Rauma. If all three loading places were handled only via one port, the cheapest solutions would be ship them via Port of Hamina. Port of Helsinki would be second cheapest and Port of Kotka would be third cheapest. Port of Hanko would be the most expensive solution.

7 SUMMARY

Activity-Based Costing revealed that costs in Finland are mostly generated by road transportation in Finland. On average 58-percent of total costs are generated by road transportation when the price is € 0.95 per kilometer. Based on these findings, the conclusion is that kilometers on road transportation should be minimized by driving as little as possible in Finland.

Activity-Based Costing also revealed that distance between the loading place and port determined strongly total cost level in Finland. Therefore the closest ports should be used for shipments if there is a possibility to use closest port for shipment from Finland to specified ports on the Continent and sea freight is at same level between ports. Almost without exception the closest port was also the cheapest one in the study. At cost point of view using the closest port would be the ideal mix of ports. There seems to be no need for concentrating cargo flows on specific ports.

From the cost point of view, DFDS Group should investigate possibilities to expand operations in future to all main ports of Finland that can be used for shipments of trailers to the Continent. Present situation is that DFDS Logistics acquires transportation services from Oy TransPeltola Ltd, Pasi Trans Oy and Koskinen-yhtiöt in Finland. TransPeltola and Pasi Trans will mainly handle traffic which is shipped via Port of Hamina. Koskinen-yhtiöt is handling most of the traffic via Port of Rauma. Sometimes trailers are shipped or collected from other port and then DFDS Logistics pays empty kilometers between ports. Based on results of the study it is highly recommendable that DFDS Logistics will research possibilities to have at least one subcontractor in all main Finnish ports.

This study could be expanded to a few directions. Firstly, total costs of transportation from loading place in Finland to the unloading place at the Continent could be researched. Research would start by finding out what would be the costs at the Continent from port to the specific unloading place. Adding costs occurred at the Continent, sea voyage fee between ports and costs occurred in Finland and the result would be minimum absorption costs from Finland to the Continent. Knowing total costs of transportation is the basis for pricing transportations.

Secondly, this study could be expanded by researching empty kilometres in Finland. As earlier mentioned, this study does not take empty kilometers to loading place into consideration. In reality, there are empty kilometers between unloading place and loading place almost in all cases. Average empty kilometers to specific loading place would be worth to find out. These costs of empty kilometers should be at the end paid by freight payers as a part of the transportation.

This study could be developed by improving more accurate first and second level cost drivers. This requires long-lasting observations of procedures of DFDS Logistics Oy. Lengthy observations were not possible to use in this study. Use of first and second level cost drivers which are results of long-lasting observations would give more accurate results. Results would be generally consistent with findings of this study but more accurate and possible slightly different. Also first and second level cost drivers could be re-thought if there is possibility to use totally different drivers.

This study was done for DFDS Logistics Oy with a practical approach. Therefore all research findings are not applicable for other logistics companies but presumably cost structures in other companies are more or less similar.

REFERENCES

Alhola, Kari 2000. Toimintolaskenta. Perusteet ja käytäntö. Helsinki: WSOY.

Annual Report of DFDS A/S 2009 (updated n.d, cited 20.10.2010)

http://dfds.com/english/investorrelations/financial%20reports%20and%20presentation/s/annualreports/documents/dfds_beretning_uk.pdf

Cooper, Robin & Kaplan, Robert S. 1991. Profit Priorities from Activity-Based Costing. Boston, Massachusetts, USA: Harvard Business Review. May-June 1991.

DFDS. 2006. DFDS 1991-2006 – Ship Development Continues. Copenhagen: Prinforparitas A/S

DFDS Update No 6. – 1 July 2010.

Finnish Port Association (updated n.d, cited 28.09.2010)

<http://www.finnports.com/statistics.php>

Frontpage - DFDS (updated n.d, cited 12.09.2010)

<http://dfds.com/english/frontpage>

Halléns nv. (updated n.d, cited 18.10.2010)

<http://www.hallens.be/main.htm>

Halléns Transport AB - Företaget (updated n.d, cited 12.09.2010)

http://www.hallens.com/main_foretaget_swe.htm

Johnson, H. Thomas & Kaplan, Robert S. 1987. Relevance Lost – The Rise and Fall of Management Accounting. Boston, Massachusetts, USA: Harvard Business School Press.

Kaplan, Robert S. & Cooper, Robin 1998. Cost & Effect – Using Integrated Cost Systems to Drive Profitability and Performance. Boston, Massachusetts, USA: Harvard Business School Press.

Kotkan Satama Oy – Port of Kotka (updated n.d, cited 28.09.2010)

http://www.portofkotka.fi/uusi/index_en.php?page=10100

Lumijärvi, Olli-Pekka & Kiiskinen, Satu & Särkilähti, Tuija 1995.

Toimintolaskenta käytännössä. Toimintolaskenta johtamisen apuvälineenä.

Juva: WSOY.

Lumijärvi, Olli-Pekka ym. 1993. Toimintojohtaminen. Activity Based Managementin suomalaisia sovellutuksia. Jyväskylä: Weilin+Göös.

Merenkululaitos 2004, Merenkulun liikenne- ja tavaravirtojen arviointi Itämerellä, Merenkululaitoksen julkaisuja 4/2004. Helsinki: Merenkululaitos.

http://portal.liikennevirasto.fi/portal/page/portal/fma_fi/tietopalvelut/julkaisut/julkaisusarjat/2004/Itameren_liikenne_raportti.pdf

Naantali : General (updated 29.09.2010, cited 29.09.2010)

http://www.naantali.fi/satama/en_GB/?flush

Norfolkline (updated n.d, cited 12.09.2010)

<http://dl1.streamzilla.jet-stream.nl/norfolkline/pdf/Finland.pdf>

Paavola, Ulla & Torppa, Pasi & Lumijärvi, Olli-Pekka 1997. Miten lisätä yrityksen arvoa. Menetelmiä omistajien tuotto-odotusten toteuttamiseksi. Porvoo: WSOY.

Port of Hamina (updated n.d, cited 28.09.2010)

<http://www.portofhamina.fi/index.php?language=7>

Port of Hanko ~ Hangon Satama (updated n.d, cited 28.09.2010)

<http://www.portofhanko.fi/eng/index.php>

Port of Helsinki (updated n.d, cited 28.09.2010)

http://www.portofhelsinki.fi/instancedata/prime_product_julkaisu/helsinginsatama/embeds/helsinginsatamawwwstructure/13347_HelSa_resume_2009_net.pdf

Port of Turku – Annual Report 2009 (updated n.d, cited 28.09.2010)

http://www.portofturku.fi/files/attachments/annual_report_2009_en.pdf

Rauman Satama | Port of Rauma (updated n.d, cited 28.09.2010)

http://www.portofrauma.com/?eng/e_roro.html

SpeedCargo (updated n.d, cited 18.10.2010)

<http://www.speedcargo.se/eng/index.html>

Vehmanen, Petri & Koskinen, Kai 1997. Tehokas kustannushallinta. Porvoo: WSOY.



Table of costs

	Terminal registration fee	Cargo charges sawn goods HS 44.06, 44.07 & 44.09	Cargo charges engines HS 84-85	Storage at open area
Port of Hamina	10,00 €	0,47 m ³ min 11,89 € per trailer	2,20 ton	free of charge
Port of Kotka -Hietanen	10,70 €	0,49 m ³ min 12,00 € per trailer	2,26 ton	1-7 days free of charge
Port of Helsinki -Vuosaari	10,45 €	1,77 ton plus 4€ extra if total fee is under 20€	3,02 ton	1-3 days free of charge
Port of Hanko	0,00 €	0,73 m ³	2,77 ton	1-10 days free of charge
Port of Turku	5,50 €	0,90 ton min 10,00 € per trailer	2,70 ton	1-3 days free of charge
Port of Naantali	0,00 €	0,62 m ³ min 20,00 € per trailer	3,65 ton	1-7 days free of charge
Port of Rauma	0,00 €	0,50 m ³ min 13,53 € per trailer	1,93 ton	1-7 days free of charge
Waiting time price	45 € per hour			all charges VAT 0 %

Table of total costs Jyväskylä	Kilometers price	Cargo: Sawn goods										Total in Finland	
		0,90 €		Weight: 24 tons		Cubic metre: 48 m3		Time at loading place: 1,25 h					
		Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	Activity one	Activity two	Activity three	Activity four		Activity five
Port of Hamina	7,90 €	13,80 €	56,25 €	216,90 €	36,95 €	26,58 €	7,90 €	13,80 €	56,25 €	216,90 €	36,95 €	26,58 €	358,38 €
Port of Kotka	7,90 €	13,80 €	56,25 €	218,70 €	63,58 €	26,58 €	7,90 €	13,80 €	56,25 €	218,70 €	63,58 €	26,58 €	386,81 €
Port of Helsinki	7,90 €	13,80 €	56,25 €	237,60 €	57,32 €	26,58 €	7,90 €	13,80 €	56,25 €	237,60 €	57,32 €	26,58 €	399,45 €
Port of Hanko	7,90 €	13,80 €	56,25 €	333,90 €	39,43 €	26,58 €	7,90 €	13,80 €	56,25 €	333,90 €	39,43 €	26,58 €	477,86 €
Port of Turku	7,90 €	13,80 €	56,25 €	279,00 €	31,49 €	26,58 €	7,90 €	13,80 €	56,25 €	279,00 €	31,49 €	26,58 €	415,02 €
Port of Naantali	7,90 €	13,80 €	56,25 €	281,70 €	34,15 €	26,58 €	7,90 €	13,80 €	56,25 €	281,70 €	34,15 €	26,58 €	420,38 €
Port of Rauma	7,90 €	13,80 €	56,25 €	267,30 €	28,39 €	26,58 €	7,90 €	13,80 €	56,25 €	267,30 €	28,39 €	26,58 €	400,22 €
Percentage of total costs													
Port of Hamina	2,20 %	3,85 %	15,70 %	60,52 %	10,31 %	7,42 %	2,20 %	3,85 %	15,70 %	60,52 %	10,31 %	7,42 %	100,00 %
Port of Kotka	2,04 %	3,57 %	14,54 %	56,54 %	16,44 %	6,87 %	2,04 %	3,57 %	14,54 %	56,54 %	16,44 %	6,87 %	100,00 %
Port of Helsinki	1,98 %	3,45 %	14,08 %	59,48 %	14,35 %	6,65 %	1,98 %	3,45 %	14,08 %	59,48 %	14,35 %	6,65 %	100,00 %
Port of Hanko	1,65 %	2,89 %	11,77 %	69,87 %	8,25 %	5,56 %	1,65 %	2,89 %	11,77 %	69,87 %	8,25 %	5,56 %	100,00 %
Port of Turku	1,90 %	3,33 %	13,55 %	67,23 %	7,59 %	6,40 %	1,90 %	3,33 %	13,55 %	67,23 %	7,59 %	6,40 %	100,00 %
Port of Naantali	1,88 %	3,28 %	13,38 %	67,01 %	8,12 %	6,32 %	1,88 %	3,28 %	13,38 %	67,01 %	8,12 %	6,32 %	100,00 %
Port of Rauma	1,97 %	3,45 %	14,05 %	66,79 %	7,09 %	6,64 %	1,97 %	3,45 %	14,05 %	66,79 %	7,09 %	6,64 %	100,00 %

Table of total costs	Kilometers price	Cargo: Sawn goods					Total in Finland						
		Weight: 24 tons	Cubic metre: 48 m3	Time at loading place: 1,25 h	Activity one	Activity two		Activity three	Activity four	Activity five	Activity ten		
Jyväskylä	0,95 €												
Port of Hamina	7,90 €	13,80 €	56,25 €	228,95 €	36,95 €	26,58 €	370,43 €						
Port of Kotka	7,90 €	13,80 €	56,25 €	230,85 €	63,58 €	26,58 €	398,96 €						
Port of Helsinki	7,90 €	13,80 €	56,25 €	250,80 €	57,32 €	26,58 €	412,65 €						
Port of Hanko	7,90 €	13,80 €	56,25 €	352,45 €	39,43 €	26,58 €	496,41 €						
Port of Turku	7,90 €	13,80 €	56,25 €	294,50 €	31,49 €	26,58 €	430,52 €						
Port of Naantali	7,90 €	13,80 €	56,25 €	297,35 €	34,15 €	26,58 €	436,03 €						
Port of Rauma	7,90 €	13,80 €	56,25 €	282,15 €	28,39 €	26,58 €	415,07 €						
Percentage of total costs													
Port of Hamina	2,13 %	3,73 %	15,19 %	61,81 %	9,97 %	7,18 %	100,00 %						
Port of Kotka	1,98 %	3,46 %	14,10 %	57,86 %	15,94 %	6,66 %	100,00 %						
Port of Helsinki	1,91 %	3,34 %	13,63 %	60,78 %	13,89 %	6,44 %	100,00 %						
Port of Hanko	1,59 %	2,78 %	11,33 %	71,00 %	7,94 %	5,35 %	100,00 %						
Port of Turku	1,83 %	3,21 %	13,07 %	68,41 %	7,31 %	6,17 %	100,00 %						
Port of Naantali	1,81 %	3,16 %	12,90 %	68,19 %	7,83 %	6,10 %	100,00 %						
Port of Rauma	1,90 %	3,32 %	13,55 %	67,98 %	6,84 %	6,40 %	100,00 %						

Table of total costs	Kilometers price	1,00 €	Cargo: Sawn goods				Total in Finland
			Weight: 24 tons	Cubic metre: 48 m3	Time at loading place: 1,25 h		
Jyväskylä	Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	
Port of Hamina	7,90 €	13,80 €	56,25 €	241,00 €	36,95 €	26,58 €	382,48 €
Port of Kotka	7,90 €	13,80 €	56,25 €	243,00 €	63,58 €	26,58 €	411,11 €
Port of Helsinki	7,90 €	13,80 €	56,25 €	264,00 €	57,32 €	26,58 €	425,85 €
Port of Hanko	7,90 €	13,80 €	56,25 €	371,00 €	39,43 €	26,58 €	514,96 €
Port of Turku	7,90 €	13,80 €	56,25 €	310,00 €	31,49 €	26,58 €	446,02 €
Port of Naantali	7,90 €	13,80 €	56,25 €	313,00 €	34,15 €	26,58 €	451,68 €
Port of Rauma	7,90 €	13,80 €	56,25 €	297,00 €	28,39 €	26,58 €	429,92 €
Percentage of total costs							
Port of Hamina	2,07 %	3,61 %	14,71 %	63,01 %	9,66 %	6,95 %	100,00 %
Port of Kotka	1,92 %	3,36 %	13,68 %	59,11 %	15,47 %	6,47 %	100,00 %
Port of Helsinki	1,86 %	3,24 %	13,21 %	61,99 %	13,46 %	6,24 %	100,00 %
Port of Hanko	1,53 %	2,68 %	10,92 %	72,04 %	7,66 %	5,16 %	100,00 %
Port of Turku	1,77 %	3,09 %	12,61 %	69,50 %	7,06 %	5,96 %	100,00 %
Port of Naantali	1,75 %	3,06 %	12,45 %	69,30 %	7,56 %	5,88 %	100,00 %
Port of Rauma	1,84 %	3,21 %	13,08 %	69,08 %	6,60 %	6,18 %	100,00 %

Table of total costs	Kilometers price	0,90 €	Cargo: Sawn goods				Total in Finland
			Weight: 22,5 tons	Cubic metre: 43 m3	Time at loading place: 0,75 h		
Lahti	Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	
Port of Hamina	7,90 €	13,80 €	33,75 €	104,40 €	34,60 €	26,58 €	221,03 €
Port of Kotka	7,90 €	13,80 €	33,75 €	106,20 €	36,16 €	26,58 €	224,39 €
Port of Helsinki	7,90 €	13,80 €	33,75 €	88,20 €	54,67 €	26,58 €	224,90 €
Port of Hanko	7,90 €	13,80 €	33,75 €	194,40 €	35,78 €	26,58 €	312,21 €
Port of Turku	7,90 €	13,80 €	33,75 €	195,30 €	30,14 €	26,58 €	307,47 €
Port of Naantali	7,90 €	13,80 €	33,75 €	206,10 €	31,05 €	26,58 €	319,18 €
Port of Rauma	7,90 €	13,80 €	33,75 €	248,40 €	25,89 €	26,58 €	356,32 €
Percentage of total costs							
Port of Hamina	3,57 %	6,24 %	15,27 %	47,23 %	15,65 %	12,03 %	100,00 %
Port of Kotka	3,52 %	6,15 %	15,04 %	47,33 %	16,11 %	11,85 %	100,00 %
Port of Helsinki	3,51 %	6,14 %	15,01 %	39,22 %	24,31 %	11,82 %	100,00 %
Port of Hanko	2,53 %	4,42 %	10,81 %	62,27 %	11,46 %	8,51 %	100,00 %
Port of Turku	2,57 %	4,49 %	10,98 %	63,52 %	9,80 %	8,64 %	100,00 %
Port of Naantali	2,48 %	4,32 %	10,57 %	64,57 %	9,73 %	8,33 %	100,00 %
Port of Rauma	2,22 %	3,87 %	9,47 %	69,71 %	7,27 %	7,46 %	100,00 %

Table of total costs	Kilometers price	Cargo: Sawn goods					Total in Finland
		0,95 €	Weight: 22,5 tons	Cubic metre: 43 m3	Time at loading place: 0,75 h		
Lahti	Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	
Port of Hamina	7,90 €	13,80 €	33,75 €	110,20 €	34,60 €	26,58 €	226,83 €
Port of Kotka	7,90 €	13,80 €	33,75 €	112,10 €	36,16 €	26,58 €	230,29 €
Port of Helsinki	7,90 €	13,80 €	33,75 €	93,10 €	54,67 €	26,58 €	229,80 €
Port of Hanko	7,90 €	13,80 €	33,75 €	205,20 €	35,78 €	26,58 €	323,01 €
Port of Turku	7,90 €	13,80 €	33,75 €	206,15 €	30,14 €	26,58 €	318,32 €
Port of Naantali	7,90 €	13,80 €	33,75 €	217,55 €	31,05 €	26,58 €	330,63 €
Port of Rauma	7,90 €	13,80 €	33,75 €	262,20 €	25,89 €	26,58 €	370,12 €
Percentage of total costs							
Port of Hamina	3,48 %	6,08 %	14,88 %	48,58 %	15,25 %	11,72 %	100,00 %
Port of Kotka	3,43 %	5,99 %	14,66 %	48,68 %	15,70 %	11,54 %	100,00 %
Port of Helsinki	3,44 %	6,01 %	14,69 %	40,51 %	23,79 %	11,57 %	100,00 %
Port of Hanko	2,45 %	4,27 %	10,45 %	63,53 %	11,08 %	8,23 %	100,00 %
Port of Turku	2,48 %	4,34 %	10,60 %	64,76 %	9,47 %	8,35 %	100,00 %
Port of Naantali	2,39 %	4,17 %	10,21 %	65,80 %	9,39 %	8,04 %	100,00 %
Port of Rauma	2,13 %	3,73 %	9,12 %	70,84 %	7,00 %	7,18 %	100,00 %

Table of total costs	Kilometers price	Cargo: Sawn goods					Total in Finland
		1,00 €	Weight: 22,5 tons	Cubic metre: 43 m3	Time at loading place: 0,75 h		
Lahti	Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	
Port of Hamina	7,90 €	13,80 €	33,75 €	116,00 €	34,60 €	26,58 €	232,63 €
Port of Kotka	7,90 €	13,80 €	33,75 €	118,00 €	36,16 €	26,58 €	236,19 €
Port of Helsinki	7,90 €	13,80 €	33,75 €	98,00 €	54,67 €	26,58 €	234,70 €
Port of Hanko	7,90 €	13,80 €	33,75 €	216,00 €	35,78 €	26,58 €	333,81 €
Port of Turku	7,90 €	13,80 €	33,75 €	217,00 €	30,14 €	26,58 €	329,17 €
Port of Naantali	7,90 €	13,80 €	33,75 €	229,00 €	31,05 €	26,58 €	342,08 €
Port of Rauma	7,90 €	13,80 €	33,75 €	276,00 €	25,89 €	26,58 €	383,92 €
Percentage of total costs							
Port of Hamina	3,40 %	5,93 %	14,51 %	49,86 %	14,87 %	11,43 %	100,00 %
Port of Kotka	3,34 %	5,84 %	14,29 %	49,96 %	15,31 %	11,25 %	100,00 %
Port of Helsinki	3,37 %	5,88 %	14,38 %	41,76 %	23,29 %	11,33 %	100,00 %
Port of Hanko	2,37 %	4,13 %	10,11 %	64,71 %	10,72 %	7,96 %	100,00 %
Port of Turku	2,40 %	4,19 %	10,25 %	65,92 %	9,16 %	8,07 %	100,00 %
Port of Naantali	2,31 %	4,03 %	9,87 %	66,94 %	9,08 %	7,77 %	100,00 %
Port of Rauma	2,06 %	3,59 %	8,79 %	71,89 %	6,74 %	6,92 %	100,00 %

Table of total costs	Kilometers price	Cargo: Engines					Total in Finland					
		0,90 €	Weight: 24 tons	Time at loading place: 1,25 h	Activity one	Activity two		Activity three	Activity four	Activity five	Activity ten	
Tampere												
Port of Hamina	7,90 €	13,80 €	56,25 €	217,80 €	67,19 €	26,58 €	389,52 €					
Port of Kotka	7,90 €	13,80 €	56,25 €	219,60 €	69,33 €	26,58 €	393,46 €					
Port of Helsinki	7,90 €	13,80 €	56,25 €	167,40 €	87,32 €	26,58 €	359,25 €					
Port of Hanko	7,90 €	13,80 €	56,25 €	208,80 €	70,87 €	26,58 €	384,20 €					
Port of Turku	7,90 €	13,80 €	56,25 €	148,50 €	74,69 €	26,58 €	327,72 €					
Port of Naantali	7,90 €	13,80 €	56,25 €	155,70 €	91,99 €	26,58 €	352,22 €					
Port of Rauma	7,90 €	13,80 €	56,25 €	131,40 €	50,71 €	26,58 €	286,64 €					
Percentage of total costs												
Port of Hamina	2,03 %	3,54 %	14,44 %	55,91 %	17,25 %	6,82 %	100,00 %					
Port of Kotka	2,01 %	3,51 %	14,30 %	55,81 %	17,62 %	6,76 %	100,00 %					
Port of Helsinki	2,20 %	3,84 %	15,66 %	46,60 %	24,31 %	7,40 %	100,00 %					
Port of Hanko	2,06 %	3,59 %	14,64 %	54,35 %	18,45 %	6,92 %	100,00 %					
Port of Turku	2,41 %	4,21 %	17,16 %	45,31 %	22,79 %	8,11 %	100,00 %					
Port of Naantali	2,24 %	3,92 %	15,97 %	44,21 %	26,12 %	7,55 %	100,00 %					
Port of Rauma	2,76 %	4,81 %	19,62 %	45,84 %	17,69 %	9,27 %	100,00 %					

Table of total costs	Kilometers price	Cargo: Engines					Total in Finland
		0,95 €	24 tons	Weight:	1,25 h	Time at loading place:	
Tampere	Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	
Port of Hamina	7,90 €	13,80 €	56,25 €	229,90 €	67,19 €	26,58 €	401,62 €
Port of Kotka	7,90 €	13,80 €	56,25 €	231,80 €	69,33 €	26,58 €	405,66 €
Port of Helsinki	7,90 €	13,80 €	56,25 €	176,70 €	87,32 €	26,58 €	368,55 €
Port of Hanko	7,90 €	13,80 €	56,25 €	220,40 €	70,87 €	26,58 €	395,80 €
Port of Turku	7,90 €	13,80 €	56,25 €	156,75 €	74,69 €	26,58 €	335,97 €
Port of Naantali	7,90 €	13,80 €	56,25 €	164,35 €	91,99 €	26,58 €	360,87 €
Port of Rauma	7,90 €	13,80 €	56,25 €	138,70 €	50,71 €	26,58 €	293,94 €
Percentage of total costs							
Port of Hamina	1,97 %	3,44 %	14,01 %	57,24 %	16,73 %	6,62 %	100,00 %
Port of Kotka	1,95 %	3,40 %	13,87 %	57,14 %	17,09 %	6,55 %	100,00 %
Port of Helsinki	2,14 %	3,74 %	15,26 %	47,94 %	23,69 %	7,21 %	100,00 %
Port of Hanko	2,00 %	3,49 %	14,21 %	55,68 %	17,91 %	6,72 %	100,00 %
Port of Turku	2,35 %	4,11 %	16,74 %	46,66 %	22,23 %	7,91 %	100,00 %
Port of Naantali	2,19 %	3,82 %	15,59 %	45,54 %	25,49 %	7,37 %	100,00 %
Port of Rauma	2,69 %	4,69 %	19,14 %	47,19 %	17,25 %	9,04 %	100,00 %

Table of total costs	Kilometers price	Cargo: Engines					Total in Finland
		1,00 €	24 tons	Time at loading place:	1,25 h		
Tampere	Activity one	Activity two	Activity three	Activity four	Activity five	Activity ten	
Port of Hamina	7,90 €	13,80 €	56,25 €	242,00 €	67,19 €	26,58 €	413,72 €
Port of Kotka	7,90 €	13,80 €	56,25 €	244,00 €	69,33 €	26,58 €	417,86 €
Port of Helsinki	7,90 €	13,80 €	56,25 €	186,00 €	87,32 €	26,58 €	377,85 €
Port of Hanko	7,90 €	13,80 €	56,25 €	232,00 €	70,87 €	26,58 €	407,40 €
Port of Turku	7,90 €	13,80 €	56,25 €	165,00 €	74,69 €	26,58 €	344,22 €
Port of Naantali	7,90 €	13,80 €	56,25 €	173,00 €	91,99 €	26,58 €	369,52 €
Port of Rauma	7,90 €	13,80 €	56,25 €	146,00 €	50,71 €	26,58 €	301,24 €
Percentage of total costs							
Port of Hamina	1,91 %	3,34 %	13,60 %	58,49 %	16,24 %	6,42 %	100,00 %
Port of Kotka	1,89 %	3,30 %	13,46 %	58,39 %	16,59 %	6,36 %	100,00 %
Port of Helsinki	2,09 %	3,65 %	14,89 %	49,23 %	23,11 %	7,03 %	100,00 %
Port of Hanko	1,94 %	3,39 %	13,81 %	56,95 %	17,40 %	6,52 %	100,00 %
Port of Turku	2,30 %	4,01 %	16,34 %	47,93 %	21,70 %	7,72 %	100,00 %
Port of Naantali	2,14 %	3,73 %	15,22 %	46,82 %	24,89 %	7,19 %	100,00 %
Port of Rauma	2,62 %	4,58 %	18,67 %	48,47 %	16,83 %	8,82 %	100,00 %