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Transportation costs for various delivery concepts for a new product

Case: Konecranes

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Abstract

The thesis and case study was addressed to Konecranes Finland Corporation, Port Cranes business unit. The company offers components, cranes and material handling solutions for wide range of industries. These are process industries, the nuclear sector, and industries handling heavy loads, ports, intermodal terminals, shipyards, and bulk material terminals.

This study was done based on project logistics point of view, on how to deliver a new product to customer, safely and with the most economical costs. Three different delivery methods; containers, break bulk shipment and charter vessel were chosen to have transit costs and transportation methods compared. The research questions that were set for this study are:

1. What are the cost difference between transportation methods and which one is most cost effective method?
2. Which one of the transportation methods would be safest for this product?

In this research, the primary approach was quantitative. All data was based on cost values for each transportation method. The solution to study the problem, was looked into by having transportation partners providing numerical data of each transportation method. To determine the safest transportation method, a SWOT analysis was done for each of these methods.

Outcome of this study can be used as guideline for future projects in Konecranes, to show how many aspects are involved with making a decision to choose a transportation method for this product, and what needs to be taken into account in making this choice.

Keywords/tags (subjects)

Transportation cost, project logistics, Konecranes, transportation methods, project management

Miscellaneous

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1 Introduction

1.1 Terminology

Shipper's own container (SOC): container that has been bought or rented by the shipper for the product or cargo.

Receiver's own container (ROC): container that has been bought or rented by the receiver for the product or cargo.

Liner or Carrier's own container (COC): container that has been rented shipping line for company to load product or cargo. COC letters are rarely used.

Origin port: place, where cargo is loaded to be shipped out to its next destination.

Discharge or unloading port: place, where cargo is off loaded from the ship.

Inland cost in export: empty container transit from port to factory for loading and back to port, export clearance for cargo and container transit to ship inside port area.

Inland cost in import: Container transit from ship to port, import clearance for cargo and container transit from port to customer, unloading and return of empty container back to port.

Site: place, where end product is installed or build.

Break bulk shipment: big components are shipped on multipurpose vessel as they are. Components are far larger in size, weight and volume and usually these cannot be loaded into containers.

In Gauge cargo (IG): cargo or product will fit into given dimensions and parameters of container.

Out Of Gauge cargo (OOG): cargo or product will not fit into given dimensions and parameters of container. Usually cargo or product is bigger in dimension, length, width, height or weight but liner will accept the cargo as is but will charge loader or shipper of used extra space in vessel.

Readiness date: the date, when cargo is ready for break bulk or charter vessel arrival or loading.

1.2 New product – same but different

When Konecranes brings a new product to market, at first this product can be seen on a dimension drawing looking like a similar product as the company has on their portfolio already. Many would then think that this new product can be handled, used, and maybe even transported the same way as the previous ones, but what needs to be done if this is not the case?

All previous used transportation methods, cost calculations templates, product handling, even project management are the same as before. But if the overall concept of this new product is conventional but little different, maybe all above mentioned things needs to be checked and re-valuated. Keeping in mind the question that, if all what has been used before is old, or can it be used again with little modification?

Since the cost of transportation can be as high as 10 - 30% of the products value, there has been indicators that from the drawing board to the actual transportation of a complete machine, some aspects can be easily missed or categorized as, same as before, and these last minute changes can be very costly during transportation. As an example, a component dimension on a product are too big for normal conventional container, then the question becomes that, should a design of this component be changed or should another form of transportation method be considered? With one centimeter or even a millimeter on a dimension drawing for the component or a product, there might be an overall increase in transportation cost.

1.3 Conventional, but different

The basic principal of the new product is, that it can be loaded into seaworthy containers or it can be transported as a complete functioning product to destination anywhere in the world. If containers are used for transportation, then what is the cost difference, if product is loaded into shipper's own containers (SOC), or receiver's

own containers (ROC), or into liner owned containers (COC)? Once delivery method has been selected then transportation cost calculations are done based on all material being shipped from origin port to discharge port. Mostly in transportation, there are additional costs coming from loading port and then vise versa from unloading port. These so called inland costs are usually based on local port costs, from possible inland transit cost, to handling costs of containers at port and to administration cost per shipment or loading. These inland costs are also calculated in the transportation cost since those are part of overall transportation cost calculation.

1.4 Company presentation - Konecranes Finland Corporation

Konecranes is a world-leading group of Lifting Businesses™, serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals. Konecranes provides productivity-enhancing lifting solutions as well as services for lifting equipment and machine tools of all makes. See Figure 1 to compare key figures between 2013 and 2014. Konecranes is listed on the Nasdaq Helsinki (symbol: KCR1V). (General description Konecranes, 2014)

Key figures	2014	2013
Orders received, MEUR	1,903.5	1,920.8
Orderbook, Dec. 31, MEUR	979.5	893.5
Sales total, MEUR	2,011.4	2,099.6
Operating profit, excl. restructuring costs, MEUR	119.1	115.5
Operating margin, excl. restructuring costs, %	5.9	5.5
Operating profit, incl. restructuring costs, MEUR	115.8	84.5
Operating margin, incl. restructuring costs, %	5.8	4.0
Profit before taxes, MEUR	107.4	75.5
Net profit for the period,MEUR	74.6	49.4
Earnings per share, basic, EUR	1.28	0.85
Earnings per share, diluted, EUR	1.28	0.85
Gearing, %	33.3	42.1
Return on capital employed, % (R12M)	17.0	11.6
Personnel on average	11,920	11,832

FIGURE 1. Konecranes Key figures in 2014.

1.4.1 Business Area Service

Through its global service network, Konecranes' Business Area Service offers full range of service solutions, specialized maintenance and modernization services for all types of industrial cranes, port equipment, and machine tools.

1.4.2 Business Area Equipment

Konecranes' Business Area Equipment offers components, cranes and material handling solutions for wide range of industries, including process industries, the nuclear sector, and industries handling heavy loads, ports, intermodal terminals, shipyards, and bulk material terminals.

1.4.3 Port Cranes part of Equipment business area

Konecranes is a major global player in the design, manufacture and servicing of container handling equipment. Excellent technology isn't enough in itself – build quality, delivery excellence, commissioning professionalism and service complete the picture from Konecranes. (Container handling equipment Konecranes, 2015)

Equipment business areas are divided as following:

- Workstation Lifting Systems
- Overhead Cranes
- Hazardous Environment Cranes and Hoists
- Container Handling Equipment
- Shipyard Cranes
- Bulk Handling Equipment
- Lift Trucks

2 Research aim and objectives

2.1 The aim of this study

This thesis is addressed to Konecranes Finland Corporation Port Cranes business unit. Thesis is done based on project logistics point of view, on how to deliver their new product to customers. Thesis is done to find out which is the most suitable and cost effective way to deliver the product to customer.

The chosen transportation ways are: components in containers, components as break bulk shipment or as fully functional product on vessel. Goal is to find out which one of these methods would be most economical and effective.

Thesis does not study the product itself nor take into account, where the possible customer is located. All cost calculation are done from origin port of Dalian, China to destination port, excluding customs clearance charges, duties and taxes at destination country. Insuring cargo is big part of safe transportation but in this study it has not been taken into account in calculations or analysis.

2.1.1 Research questions

In this thesis, the main research problem is: How to find the most cost effective way to transport a product from origin port to its destination? And which one of these transportation methods would be the safest one for this product? In order to find the solution to these problems, answers to the following questions were looked for:

1. What are the cost difference between transportation methods and which one is most cost effective method for
    a. components in containers?
    b. components as break bulk shipment?
    c. a fully functional product on multipurpose vessel?
2. Which one of the transportation methods would be safest for this product?

The answers to question 1 was done with the co-operation of Konecranes' forwarding partners by sending a quotation request to them. Quotation included information of how many containers are required, and from which origin the containers are loaded into vessel, and to which destination containers are heading for unloading. But the multipurpose vessel quotations which includes the weight, total dimensions and readiness date of the transported product were sent to various shipping agents.

The answers to question 2 are to determine the safest method of transportation. This is done by studying, where a product would have the least amount of handling steps from origin port to its destination. The study should also be look at from the products point of view, since that is what's been guarded during transportation.

2.1.2 Research methods

According to Hirsjärvi, Remes and Sajavaara (2010), lists three traditional research strategies: Experimental, Survey and Case Study. All are discussed shortly below as explained by Hirsjärvi, Remes and Sajavaara. (pp. 134 - 135).

Experimental Research usually includes testing of hypotheses. The hypotheses are tested by selecting samples from known populations, deliberately and systematically allocating these samples to different experiment conditions, introducing a planned change of one or several variables, and measuring these variables numerically and controlling other variables.

In **Survey Research** a sample of a specific population is chosen and data is then collected from each individual in a structured fashion, usually using questionnaires or structured interviews. The aim is to describe, compare and explain events and phenomena.

Case study involves an in-depth examination of a single event or instance, i.e. a case. The case is examined from the focus point of an individual, group or community in its natural environment. Data is collected using several methods, among others observations, interviews and documentary analysis. The aim is typically to describe phenomena.

In this thesis a Case Study was applied –work was made for Konecranes Finland Corporation and it is not applicable to any other company.

2.1.3 Quantitative & Qualitative research

There are two approaches to a research problem: Qualitative and Quantitative Research. According to Hirsjärvi et. al. (2010, 135- 137), these approaches complement each other and are hard to separate from each other. Table below (table 1) presents the characteristics of both types of research from eight different points of view. (Comparing quantitative and qualitative research 2009.)

Table 1. Comparison of quantitative and qualitative research.

	Qualitative	Quantitative
Data being gathered	Mainly verbal data.	Measurable data.
How is the data being analyzed	In an interpretative manner, subjective, impressionistic or even diagnostic.	Counting and classifying features and constructing statistical models and figures.
Data being generated	Non-numerical data.	Numerical data or information that can be converted into numbers.
Goal or Aim of the research	To provide a complete, detailed description of the research topic.	To explain what is observed.
Usage	Ideal for earlier phases of research projects.	Recommended for the latter part of the research project. Provides the researcher a clearer picture of what to expect in his research.
Data Gathering Instrument	The researcher serves as the primary data gathering instrument employing various data-gathering strategies, e.g. individual in-depth interviews, structured and non-structured interviews, focus groups, narratives, content or documentary analysis, participant observation and archival research.	Makes use of tools such as questionnaires, surveys and other equipment collecting measurable data.
Type of Data	In the form of words (from interviews) and images (videos) or objects (such as artifacts) and figures in	Tables containing data in the form of numbers and statistics.
Approach	Subjective.	Objective.

In this research the primary approach was quantitative research. In the Case Study numerical data had to be gathered, when defining the most cost effective transportation method.

2.1.4 SWOT – analysis

A SWOT analysis is a planning tool used to understand the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business. It involves specifying the objective of the business or project and identifying the internal and external

factors that are supportive or unfavorable to achieving that objective. The methodology (SWOT analysis) has the advantage of being used as a 'quick and dirty' tool or a comprehensive management tool, more importantly this is not a decision that has to be made in advanced as one can lead to the other. This flexibility is one of the factors that has contributed to its success, along with many believing it is light weight, due to their lack of its original purpose. (The Complete History and Guide to SWOT Analysis, 2014)

A SWOT analysis can be used for:

- Workshop sessions
- Brainstorm meetings
- Problem solving
- Planning
- Product evaluation
- Competitor evaluation
- Personal Development Planning
- Decision Making

In this thesis, SWOT analysis was used for problem solving since one of research questions is which on of the given transportation methods would be safest for this product. For SWOT –analysis a group of project logistics specialist gather together into brainstorm meeting to collect ideas and thoughts for this research question.

3 Logistics, Project & Project Logistics

3.1 Definition on logistics

"Logistics means having the right thing, at the right place, at the right time."

This is how Logistics World defines the word "logistics". Logistics is a flow of material, capital and controlling of information flow linked to these. With logistics, the aim is to optimize held capital in processes so that service to customer stays in satisfactory

level. (Hörkkö, Koskinen, Laitinen, Mattson, Ollikainen, Reinikainen & Werdermann 2010, 52–53.)

3.2 Definition of project

Project is a usually time limited agreement with certain scope, goals, resources and budget. Project business is a part of a bigger process including sales, marketing and after sales services. Project Management Institute (PMI) describes characteristics for project as man designed, executed, controlled. Projects has got limited resources and those are temporary and also provided product or service can be unique. (Kasvi, Ruuska, Vartiainen 2003, 13.)

Success in project usually requires following items to work together seamlessly; project management, project organization and customer point of view.

Project management is required to push through the project according to given schedule and according to budget. Control and execution must be effective and with good quality to reach set goals for project.

Project organization has been selected by each person's expertise. Project itself is profitable for company either in short or long term. All parties involved in project organization are satisfied with the end result.

Customer has selected this particular company as their partner to fulfill this project so that the customer and possible end users are satisfied with the project. And if the customer point of view is reached this project can be used as reference case on both sides in future. (Kasvi, Ruuska, Vartiainen 2003, 16.)

3.2.1 Shipment project

Shipment project starts with sales meeting, and once all details are in line for actual sales, then more parties are brought to play; like designers, production, delivery and assembly. Shipment projects can last from few weeks to several months and usually many delivery project are ongoing at the same time.

Overall understanding of the shipment project is the key for project success. The role of project management and project organization are crucial since communication, information flow and interaction must be on high level at all the time during project, and having all parties involved working for same goal. Human interaction is usually needed more during project execution, but the flow of information should not only be controlled with computer systems, since interaction of parties must work also on a high level during whole the process. Shipment projects are usually handled with a wide network. Both internal and external interest groups are aiming for the same goal of having a high quality product and fast delivery to customer. (Kasvi, Ruuska, Vartiainen 2003, 111-118.)

3.3 Project logistics

Project logistics means all logistics related to a project type of work and supporting its success. Project logistics has got the same characteristics as normal logistics, such as procurement, storing and transportation.
Project logistics usually has got some special requirements such as dimensions of the cargo or volume of batch. Project logistics requires special skills to understand the requirements of logistics. These skills are usually needed in production phase as well as in consulting transportation or storing matters. Project logistics also requires understanding of forwarding, international trade and knowlegde of delivery terms. As mentioned earlier, logistics and project logistics has got same characteristics, and therefore method of arranging transportation part of process are the same. Procurement is done by starting from quotation and partner selection for placing an order, along defining special requirements in project logistics and ending up with approving an invoice of purchased logistic services.

3.4 Project transportation

Project transportation means, transportation that is linked directly to project execution. Project transportation is meant to support project execution by having right cargo in right place at the right time. It is more common with project transportation that planning for the actual shipment has started long before the

actual cargo is moved. This way the transportation processes role for the project enhances its execution on time.

As mentioned earlier, typical project transportation is more commonly over size by dimensions or in weight. Also the amount of transported batches might vary which also sets challenges to the logistics service provider. Having material in right place at the right time is still the key for projects success. Delivery at the right time will also minimize extra handling of the cargo, and therefore limit risks of delivering damaged cargo to customer. Also this way all extra storing costs are cut to a minimum and no capital is tied down to none value adding steps. When discussing about project transportation from planning to execution, it is easier said than done. There are many variables along the way, and most of them should be considered or at least be recognized, when planning project transportation. Here is a list of few variables in random order for project transportation:

- Planned vessel, container or package is too small for cargo,
- Rotation schedule for container vessel has changed,
- Wrong type of container has been delivered to loading place,
- No onward transit available for cargo,
- Cargo is in a wrong quay for loading,
- Weather conditions prevents operations in port,
- Bad weather conditions on sea voyage causes delay for cargo.

3.5 Mode of transportation in project logistics

The mode of transportation that are in use for project transportation, varies by field of industry. For example medical industry relies on air freight deliveries, due to small size of packages and smaller volumes. Also phone industry uses often air freight, due to high value products or demand for JIT (just-in-time) delivery is required. Heavy and high volume cargo is usually more feasible to transport via ocean freight. Charter vessels are used, when volume and weight of cargo so demands. For truck freight there is no exact rule, when it can or should be used, but usually local laws and road transportation regulations will specify, what can and cannot be moved on road.

3.5.1 Air freight

Air freight transportation is highly regulated due to aviation laws and due to the fact that most of the air freight cargo is carried in civil transport aircrafts. Design for air freight containers varies by aircraft and airline. Shape of aircraft determines, which type of air cargo container will suit for each aircraft. See figure 3, for air freight container types and dimensions. Exact dimensions and weight limitations will vary by manufacturer, and availability will vary by air carrier and trade lane. All containers in aircrafts are done according to ISO -standards. (ISO 55.180.30: Air mode containers, pallets and nets)

3.5.1.1 Air freight container types and dimensions:

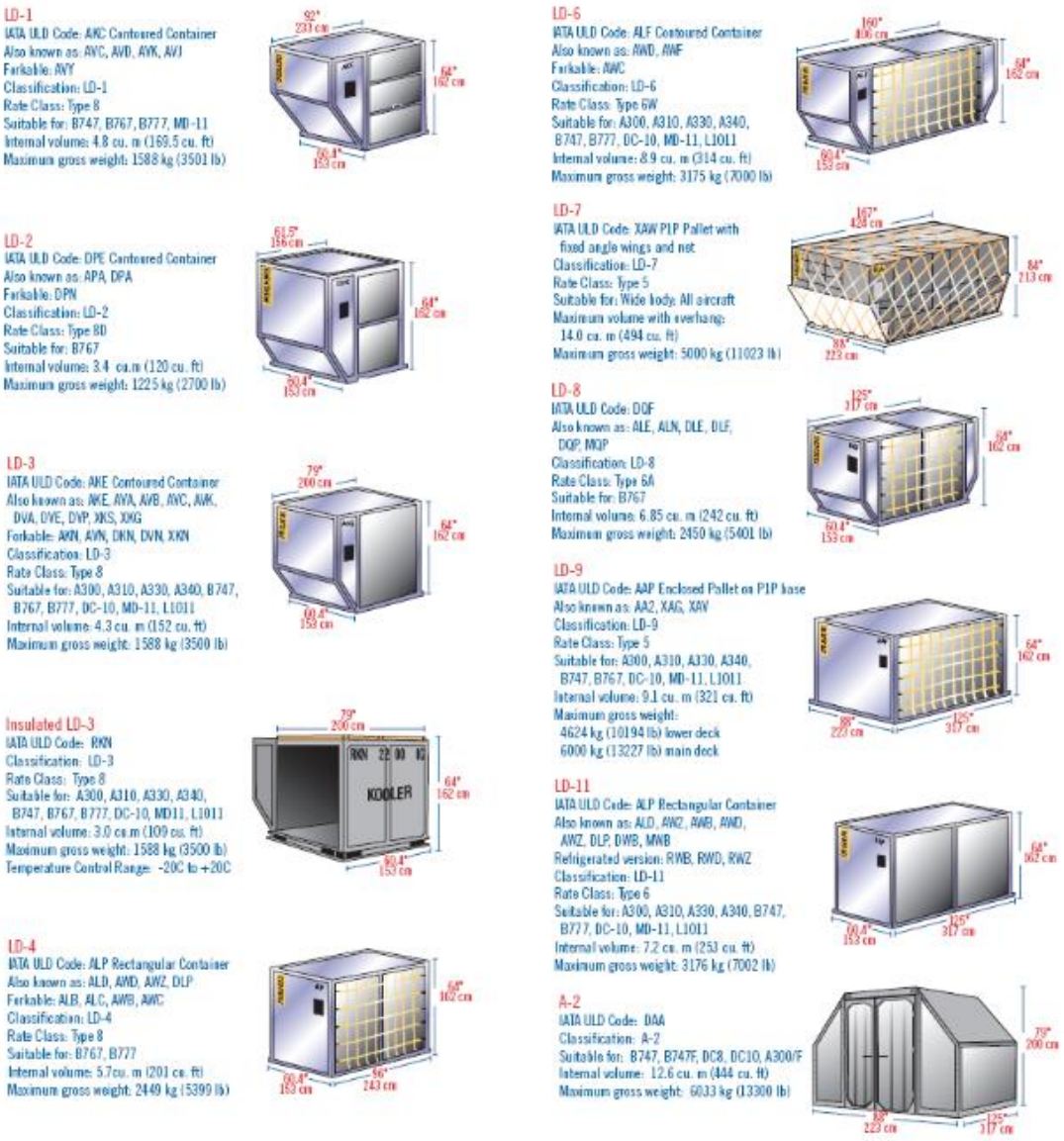

FIGURE 3. Airfreight containers, (ULD) Unit Load Devices.

3.5.2 Ocean freight

Like mentioned earlier, heavy and big volume cargo is usually more feasible to be transported by ocean freight. Usually for ocean freight standardized containers are used for transport method. High volume packages are easier and faster to load into ocean freight container than loading those into vessel cargo hold one at a time.

Container is a box simply defined according to the term of its use. These box containers are of different forms but have an identical rectangular shape. A standard outer leaf that has the ability to resist and protect what is inside and of a permanent

character and is strong enough for repeated use. (Customs Convention on Containers, 1972)

3.5.2.1 Container types

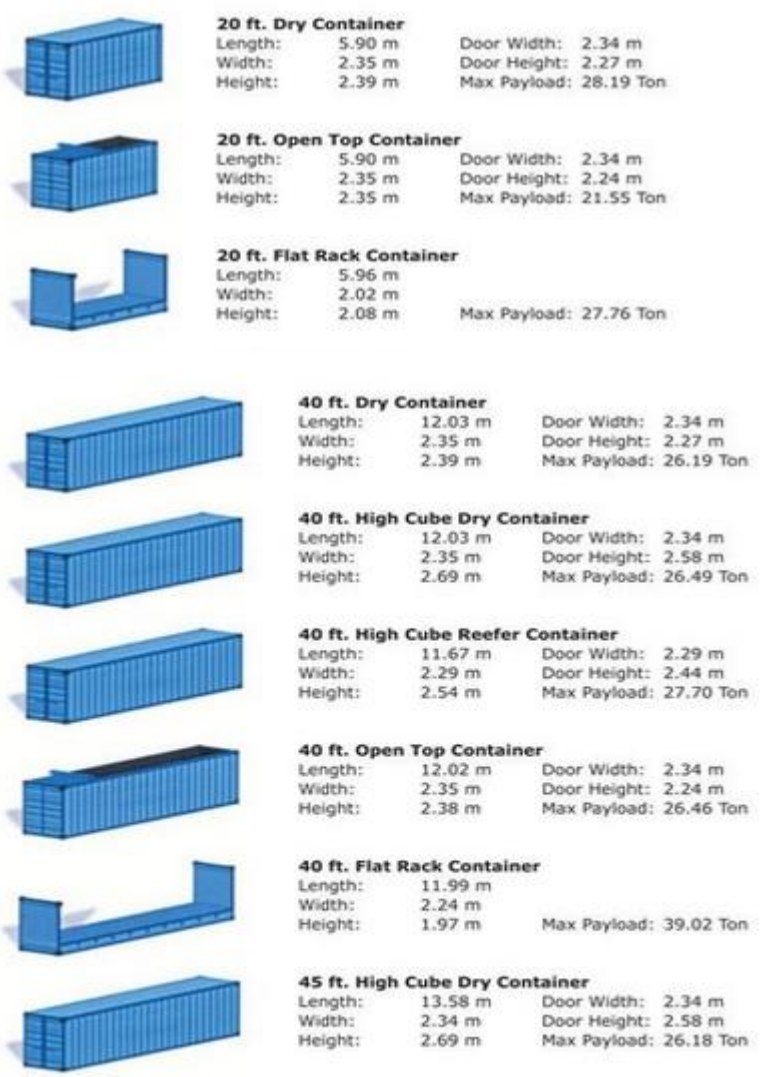

FIGURE 4. Types of containers.

In project transportation along with widely used general cargo containers 20ft and 40ft dry container, almost all other type of containers are also used. Open top containers are commonly used, when loading or unloading of cargo is done through roof, or cargo is over height. Flat rack containers are also used, when cargo is oversize but vessel liner approves this cargo to their vessel hold. High cube containers are handy, when cargo is over height, but requires protection around it and can be unloaded at the destination without problems. Reefer containers are usually used for food sup-

plies transit. Reefer container is temperature control container. Also other temperature sensitive cargo like resins, chemicals, pharmaceutical materials are transported in reefer containers.

If size of cargo is bigger, than container allows, it is possible that sometimes shipping companies will take so called “out of gauge” (OOG) cargo in their vessel. OOG cargo is normally carried in open top containers or flat racks due to the nature and size of the cargo. OOG cargo can mean for example that open top containers roof section is little bit higher than the actual top frame of the container. Shipping company will charge extra for extra space used in vessel for this container loading. Now they have to load the container into vessel so that nothing can be loaded on top of this container. This is how and why shipping companies will get shipper or loader to pay extra money for this type of OOG cargo. Cargo dimensions can be over from width or length also.

Risk of damaged goods becomes higher for OOG cargo, due to possible collisions in vessel hold during loading and unloading.

On the other hand, if cargo will fit into container of any type, cargo is called “in gauge” cargo (IG). These alphabets means, that cargo is not oversize to any direction and can be safely loaded to its right location in vessel hold.

Since container are owned by carrier or shipping line, they will also prefer transporting their own containers. The advantage of the loading order to the vessel hold is given to carriers or alliance partners first. SOC and ROC containers can be left out of the vessel, if there is no space or an over booking has been done at the port. The same might happen, if carrier’s competitor’s containers are transported from one port to the next. Carrier’s has been given the power to choose, which containers are loaded into the vessels first all over the world, since most the worlds port operations are owned by carriers.

3.5.2.2 Inland cost in ocean freight

Interpretation of codes and meaning of them in forwarding agent quotation, can be fairly difficult and challenging to understand. There are THC, ISPS, booking fee, port charges, IT transmission, equipment fee, port fees, BL fee, documentation fee and many others. Same fees might be named differently by another forwarding agent so making price comparison can be very difficult.

Terminology of basic code and their meanings in freight forwarders quotation and documents:

Terminal Handling Charges (THC) = is the charges collected by terminal authorities at each port against handling equipment and maintenance. THC varies from port to port of each country. The cost of handling at each port differs one to another port, depends up on the total cost of port terminal handling at each location. Also can be shown as Origin terminal handling charges (OTHC) port related expenses vs. Destination terminal handling charges (DTHC) – unloading port related expenses. Charge are based per unit. Unit can be a container.

Port Charges or equipment fee= taxes and surcharge, which apply to a ship and/or the cargo on board the ship, once it has reached the port. Charge are based per unit. Unit can be a container.

Documentation fee (DOC fee) = fees local agent line for paperwork. May apply for a bill of lading or container. Charge are based per set. Set can be one invoice or one bill of lading for shipment.

Currency adjustment factor (CAF) = currency exchange difference bases on ocean freight cost.

Bunker adjustment factor (BAF) = fuel expenses charge calculated in USD for TEU (20 foot container)

Security charges (ISPS or SEC or CSF) = port security related expenses and Carrier Security Fee. Charge are based per unit. Unit can be a container.

Booking fee = electronic booking to organize, the dropping off and collection of empty containers. Trucks are having a dedicated time slot to enter the container park. This will reduce truck queues' and therefore reduce expensive truck waiting time costs. Charge are based per unit. Unit can be a container.

Manual Documentation Processing free (MDF) = will be applied whenever the shipping instruction are submitted via email. Charge are based per unit. Unit can be a container.

Telex release fee = is an electronic message, that is sent by the shipping line or agent at load port to their office or agent at discharge port. Advising that the shipper or exporter has surrendered one or all of the original bills of lading that have been issued to them. The cargo can then be released to the consignee shown on the bill of lading without presentation of any original bills of lading. Charge are based per bill of lading.

Bill of lading fee (BL fee) = is documentation charges of shipping carriers to shipper, when releasing Bill of Lading.

As mentioned earlier, there are many other explanation for these basic codes. Therefore the fees might be different with another forwarding agent. These codes will vary from country to country or from shipment to shipment.

3.5.3 Charter vessel

In project logistics, it is also possible that, when the size of cargo is so big that conventional methods are not enough, companies can hire a chartered vessel to delivery their project cargo. In chartered vessel, it is possible to deliver for example a complete product or even a whole project all at once to its next location. Charter vessels can load cargo also in non-commercial ports. These are ports that do not have regular operation all year round but they fulfill the requirements for specific vessel to berth at their quay for loading. Also unloading to green ports can be done. Green ports are places, which are still under construction and are not yet in operational use for any other vessels. Green ports usually requires that vessel can unload the cargo to quay with its own on board equipment.

Chartered vessels can usually take any type of cargo. Vessels are so called multi-purpose vessels. Multipurpose vessels are notable for versatility. Most of these vessels are capable of transporting dry cargo of all types, and are equipped with shipboard

handling gear. Capacity of shipboard cranes is expressed in tons as the SWL or Safe Working Load. This is the maximum permissible load for the hoisting device.

As an example; in project logistics, there can be all kind of containers, or individual big or small components in the actual project delivery scope. Project cargo can be either measured big in weight, size or volume, and having all these packed into the same vessel and delivered all in one lot. This can save time and transportation cost.

Charter vessels that are used for project shipments can vary, based on cargo or project. Crude oil, grain or coal shipments requires a specific type of vessel (see figure 5.) (Wall Street daily, Nov. 2014) and components for an oil rig or container yard crane requires another type of vessel. (See figure 6.) (World Maritime News, June, 2015)

FIGURE 5. Oil tanker in full load.

FIGURE 6. 3 RTG Cranes on general cargo carrier M/V Meri.

The preparation of any charter vessel transportation can start as early as a year before the actual shipping takes place. Once a partner for the shipment has been selected, starts the planning and engineering for loading the cargo into the specific vessel. Since cargo sizes and weight of cargo or component can vary a lot, vessels companies select's from their fleet, see Figure 6 for a vessel that is most suitable for specific cargo to be used and then sets their technical department to plan the loading for each component of cargo separately to this specific type of vessel. Loading plans will require detailed drawings of each component. This can lead to a design change for product in hand, if it is possible. For example; some removable components are not attached to the shipped cargo, just to save space, or to save cargo from being damaged during lashing, and securing the cargo for sea voyage.

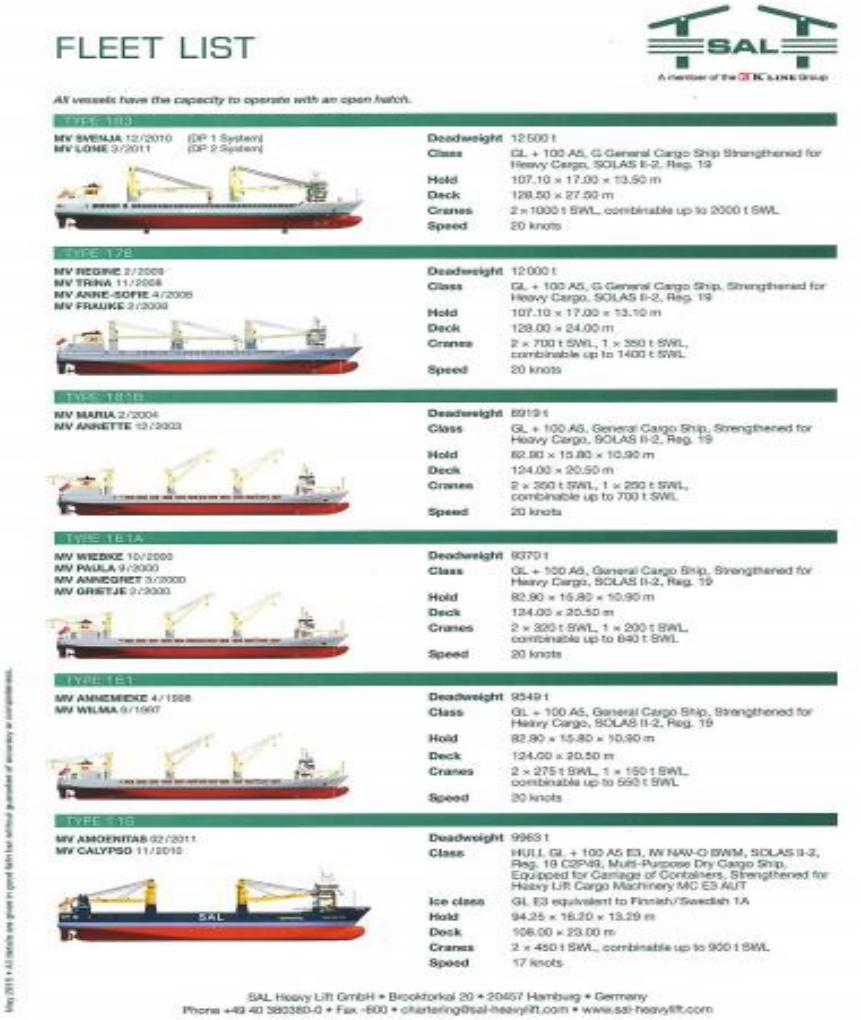

FIGURE 7. SAL Heavy Lift GmbH, Fleet list. (SAL Heavy Lift GmbH, 2015)

To load or unload chartered vessel, there are usually stevedorers needed for this work. According to International Institute of Marine Surveying, word "stevedoring" in

Europe and “longshoremen” in USA, means the people who handle the cargo on merchant or commercial shipping vessels. Chartered vessels make money at sea, when carrying its cargo between ports, but when it is alongside at port, it is costing money to its owner. Therefore ports and terminals need to be efficient to minimise time at port, and get the vessel back on its next journey as soon as possible. The role of stevedoring companies, which organises the cargo-handling in ports are very important. Time at port can make a great difference to the profitability of the voyage.

Today’s stevedoring companies and their skilled personnel operate a selection of expensive and sophisticated cargo handling equipment in ports and terminals around the world. (The role of stevedores in shipping, September 15, 2014)

Charges for stevedoring are usually based on hour rates. In some countries these charges are mandated by dockworkers unions. Other charges for loading and unloading at quay are port charges. This cost can also be based on hour rate or to the amount of cargo. The amount of cargo can be measured either by weight (tonnage) or by how many lifting actions has been made by port equipments.

3.5.4 Truck freight

Truck freight shipping is the movement of large amounts of homogeneous cargo, generally the amount necessary to fill an entire semi-trailer or intermodal container. A truckload carrier is a trucking company that generally contracts an entire trailer-load to a single customer. Full Truckload (FTL) carriers advantage over Less than Truckload (LTL) carriers is that the freight is never handled en route, whereas an LTL shipment will typically be transported on several different trailers and handled by several different parties along the way. LTL truck freigh has mixed freight from several customers in each trailer.

Full truckload carriers normally deliver a semi trailer to a shipper, who will fill the trailer with freight for one destination. After the trailer is loaded, the driver returns to the shipper to collect the required paperwork (i.e. bill of lading, invoice, and

customs paperwork) and depart with the trailer containing freight. In most cases the driver then proceeds directly to the consignee and delivers the freight to named destination. Occasionally, a driver will transfer the trailer to another driver who will drive the freight the rest of the way. Full Truckload (FTL) transit times are normally constrained by the driver's availability according to hours of service regulations and distance.

Because truck freight carriers are asked to ship a wide variety of items, a truck freight carrier will often specialize in moving a specific kind of freight. Some carriers will primarily transport food and perishable items, whereas others may specialize in moving poisonous and hazardous materials. Carriers will only transport specific freight because transportation equipment and insurancies.

3.5.4.1 Truck types and dimensions

- Box Trailer, Curtain Trailer, Tarpaulin Trailer
- Mega Trailer
- Open Trailer
- Reefer Trailer (See Figure 8-11.)

http://www.dsv.com/road-transport/trailer-types-and-dimensions

FIGURE 8. Box, Curtain, Tarpaulin Trailer

FIGURE 9. Mega Trailer

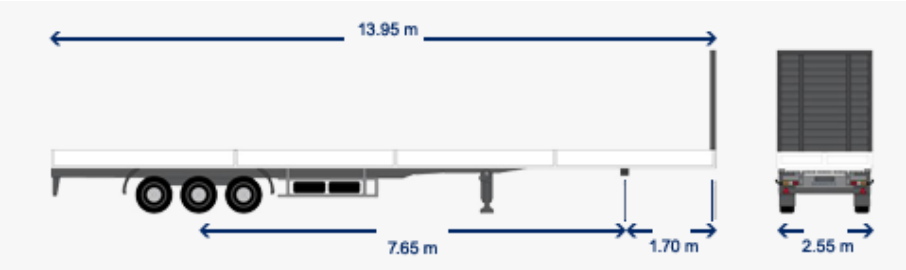

FIGURE 10. Open Trailer

FIGURE 11. Reefer Trailer

Freight is usually loaded onto pallets for unit loads. Sturdy shipping containers such as crates or corrugated fiberboard boxes are commonly used . Carriers have published tariffs that provides guidance for packaging. Packaging engineers design and test packaging to meet the specific needs of the logistics system and the product being shipped. Truck freight shipments are sometimes broken down into individual containers and further shipped by LTL or express carriers. Packaging for truck freight cargo often needs to withstand the more severe handling of individual shipments.

3.6 Project forwarding

A freight forwarder or forwarding agent, also known as a non-vessel operating common carrier, is a person or company that organizes shipments for corporations to get goods from the manufacturer or producer to market, customer or final point of distribution. Forwarders contract usually with multiple carriers to move the goods. A forwarder does not move the goods but acts as an expert in the logistics network.

These forwarders can use a variety of shipping modes; including ships, airplanes, trucks, and railroads. Often multiple shipping modes can be used for a single shipment. (Freight forwarder. Random House Unabridged Dictionary, 1997)

International freight forwarders typically handle international shipments. International freight forwarders have additional expertise in preparing and processing customs and other documentation and performing activities pertaining to international shipments. Information typically reviewed by a freight forwarder includes the commercial invoice, shipper's export declaration, bill of lading and other documents required by the carrier or country of export, import, and/or transshipment. (See Figure 12.) Much of this information is now processed in a paperless environment. (International Cargo Express News, March, 2014)

The International Federation of Freight Forwarders Associations (FIATA) shorthand description of the freight forwarder as the 'Architect of Transport' illustrates the commercial position of the forwarder relative to its client. In Europe, some forwarders specialize in 'niche' areas such as rail-freight, and collection and deliveries around a large port. (International Federation of Freight Forwarders Associations, May 2013)

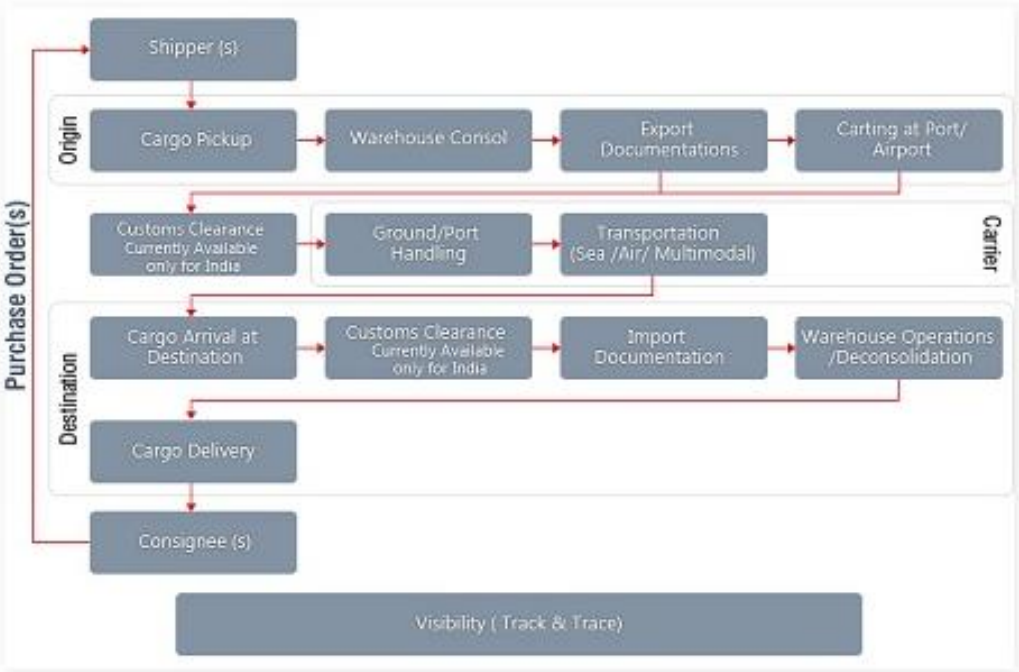

FIGURE 12. Freight forwarding flow chart.

Freight forwarders handle the logistics, which often becomes the most challenging part of the business. They assist in guaranteeing that products (in whatever sellable and acceptable form they come) arrive within the set deadline to the proper location. They also guarantee that the products arrive in the best possible condition to wherever they need to be in the world. Their skills and specialties' also ensure that challenges to the company, specifically those needing logistical management brought about by many factors, such as distance, time, etc., are bridged and met, especially for those businesses that need to send international cargo on a regular basis.

The importance and advantages of freight forwarding:

1. Freight forwarding makes large-scale shipping less complicated, because their extensive knowledge of proper procedures. They make certain, that cargo is cleared, by dealing with the challenging work of paperwork, documentations and customs. They organize every step involving transportation of freight, ensuring that the delivery flow is smooth.

2. Freight forwarders are built for the purpose of arranging any kind of shipments. They can assist, if needed, to get a grip of products and assets by fully managing company inventory, by reporting what is on hand and where it is.

3. Freight forwarders can provide professional advice and services that can offer relief to logistic operations in many ways. Forwarders have vast know-how in logistics area and are experts in guiding how to manage export business.

4. A good freight forwarder saves company labor as they can take care of the otherwise difficult task of transporting. They can also minimize cost in the long run since essential details of the delivery, billing and invoicing are taken care of and are well tracked from their end. Placed investments are returned properly by minimizing the time which the shipment reaches the destination. (Transglobal Express, January 2011)

4 The Total Cost Effects

The total cost effects should be considered, when making a decision of making acquisition and selecting a partner for it. What is being acquired? How much it's going to cost? Also skill level of the organization will influence this acquisition process. One way to classify the acquisition decision process is to identify which criteria's will affect the total cost (Axelsson, 2005):

1) Price
    a. Selection is based only for acquisition price. Price is usually usable criteria, when the acquisition or demands for its specification are very few or product is standardized.

2) Intuition, preference and habit
    a. Selection is based on personal images, customs, preference, values or for small single variants in between options.

3) Objective comparison
    a. Selection is based on versatile objective information, product specification and acquisition costs, but indirect costs effects are not observed.

4) Ad hoc –cost calculation
    a. Total cost effects of all options are pointed out case by case or per project.

5) Formal total cost effect calculation
    a. Company has set a controlled acquisition decision making process, which considers available information and also total cost effects. There are clear instructions, for which situations this should be done and how the total cost effects should be calculated.

6) Systematic total cost monitoring and supervision
    a. Total cost effects are continuously utilized for suppliers and to the whole acquisition methods, which are developed and improved with valuating successes and monitoring.

7) Regular risk and threat cost effect valuation
    a. Fast global changes forces to valuate total cost effects from political and social perspective. Risks and threats can come from anywhere. Security, welfare and crisis on society and governmental level affects taxes, fees, duties and ethical questions. Also environmental risk and preventing them are valuated and priced as part of total cost effect. (Hankintojen johtaminen, 2012, 157-159)

In Finland, and in various organizations, acquisition decision are usually made in between groups 1-4. In many cases price is the sole criteria in decision making. Total cost effects are thought and calculated, and benefits from it are recognized but applying them still needs improvement. In certain cases price and personal preference are good criteria's to use, but in some cases, the total cost effect calculation should be used regularly and used more for bases of selection.

Total cost effect calculation can mean more work if it does not add value to the decision making, and if all costs cannot be identify in the process, it should not be done. (Hankintojen johtaminen, 2012, 158 - 159)

4.1 Cost effects of logistics

Capital is required for maintaining a trade. In logistics chain equity is usually tied down to procurement, storage and transportation, while no payment has been received from customer. Logistics chain has also got costs factors that do not tie equity but these are seen in lost and profit statements. For example transportation are cost factors that do not tie equity the same way as storing costs. Logistics cost factors can be divided into following categories:

- transportation costs,
- storing costs,
- storing costs effecting lost and profit statement,
- administration costs,
- packing costs,
- other equity costs. (Hörkkö am. 2010, 52-53)

Transportation costs are direct or indirect costs linked to transporting the goods. These costs are fuel, salary, vehicle maintenance and equipment costs. Transportation costs also includes logistics service providers administration costs which are included to the invoiced sum. (Karhunen, Pouri & Santala 2008, 90–91.) Transportation cost are typicly compared to be overall logistic costs, while transpor-

tation is only part of logistic cost. Usually long term partnership with logistics service providers can provide reduction to transportation cost.

Storing material in warehouse means tieing equity, and storing as itself, does not add any value to most of the products. In overall logistic costs, storing can be about 25% of total transportation cost. Storage space and extra material handling are the main causes for storing costs. Equity cost of storing comes from storage value and its interest set in the equity itself, or if equity is tied down to storing, then the actual sum of money is out of productive actions and therefore the sum can be looked at as lost income.

Administration cost are formed from human work. These cost are not from transporting or storing. Administration costs comes from example logistics planning, development, documentation and other administrative duties. To improve the functions and cost structure in administration costs, is to have overlapping administration work checked and minimized, since most of the time it brings efficiency and added value for service provider and producer. Biggest development steps has been done to minimaze non value adding work in supply chain and this pattern will continue to stay popular in future. (Hörkkö am 2010, 52-53)

Packing costs are for most deliveries a mandatory expense, but with relatively simple steps packing costs can be reduced. By designing and planning packing material usage, it is possible to find optimal solution to meet companies needs. Thinking green and having enviromently friendly and recyclable material used for packing, it will have an impact to packing costs. (ibid. 52-53) How to pack products, and with which material, should be planned with long term principle. Resources that are used for it, will bring savings in the long term.

Upkeeping of logistic operations will tie down company capital. Other capital costs includes vital actions for business operations, like handling interest costs of arranging

external financing. Logistic services are hard to provide without having capital tied down to machinery and work space. Figure 13. will show you the avarage cost ratio of logistics items. (Alagh, Transportation, 2015)

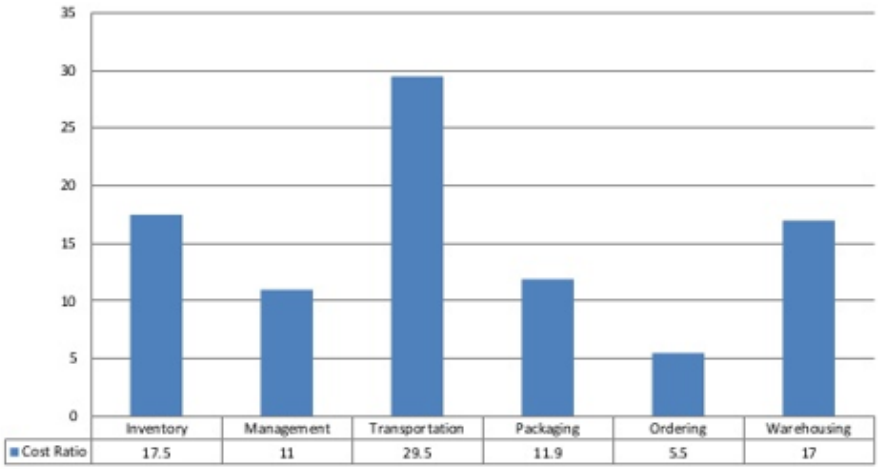

Figure 13. Cost ratio of logistic items. (addabted from Alagh, Transportation)

In N. Jena and Nitin Seth's article: "Factors influencing logistics cost and service quality: a survey within the Indian steel sector", Industrial and Commercial Training, Vol. 48 Iss 4 pp. 201, they are referring to inbound and outbound transportation costs. See enclosed table to demonstrate to link between these two.

Table 2. Elements of inbound and outbound logistics.

Elements of inbound logistics	*Elements of outbound logistics*
(a) Ex-works cost to plant	(a) Packing and container cleaning
(b) Air/water transportation	(b) Inland transportation cost to port
(c) Port handling charges	(c) Port handling charges
(d) Documentation and customs clearances	(d) Documentation and customs clearances
(e) Warehousing charges	(e) Sea freight
(f) Inland transportation	(f) DAP (Delivered at place) – buyers go-down

Source: Adopted from State of Logistics report from CSCMP, 2013 and Council of Logistics Management (2013)

Despite this article is referring to Indian steel industry, all the above elements are linked to logistics, project kind logistics or any other kind also.

Inbound logistics refers to all material movements from supplier to the factory or subcontractor. On the other hand outbound logistics is most of the time linked to transportation from factory or subcontractor to customer or products final destination.

In overall logistics calculation these two elements might be calculated into one data depending on the industry or product at hand.

In same article of N. Jena and Nitin Seth's (ibid., 202), they have stated the factors influencing logistics cost and those has been categorized into controllable and non-controllable factors.

Some of the factors by which the logistics cost can be controlled are:

1. Increasing the performance efficiency by reducing the non-value added activities.
2. Planning effective transportation.
3. Increasing the effectiveness of predicting the demand of relevant to the need of customer and transportation plan.
4. Developing the information technology system to link and exchange information within organization, between organization and between government sector and entrepreneur.

Also, non-controllable factors affecting the logistics cost include oil prices, interest rate, exchange rate and inflation.

In today's logistics world, these non-controllable factors also forces the forwarding agent to limit their quotation validity time. This validity time in quotation is now much shorter than in the past. Since cost of these non-controllable factors are changing so frequently, even daily, for example a freight quotation is now valid only for 1 month. Risk of losing money, if quotation is valid longer, can be very costly for either party in this quotation.

5 Cost of transportation for Konecranes' new product – Outcomes of the thesis

The answers found as outcomes of the thesis research question 1 are shown below. The Case Study was made based on a project that was already delivered. Collected

data was based on transportation quotations, which were received prior shipping the product to its final destination.

Answer to research question 1

To compare information based on quotation, it can be seen that choosing container transportation to this product was the most cost effective method. The cost with any type of container SOC, ROC or COC was cheaper than selection break bulk or chartered vessel. See appendix 4 to compare the total cost of all transportation methods in one sheet.

Break bulk and charter vessel were fairly close to each other but not as economical as container.

5.1 Components in containers

5.1.1 Answer to ROC & SOC container transit

When these answers were studied from received quotations, it was noticed that there was no price difference on ocean freight cost between ROC and SOC containers. For shipping line it did not matter, who owned the containers, and therefore price was same for both. See Appendix 1 which demonstrates the prices and differences.

However the cost differences came from inland transportation cost inside of China. Since all forwarding agents had asked their quotation prices from different shipping lines, you were able to see the variation in prices. In most of the quotation, they had different charges for inland costs despite departure port was the same for each of them. See appendix 2 which shows the price differences between 5 forwarding agents related to inland costs in China. All price comparison at this stage has been calculated based on quotation requirements of 16 pieces of SOC High Cube containers.

5.1.2 Answer to liner owned container transit

For these liner or carrier owned container (COC), a small price reduction on ocean freight cost was found in few of the quotations. Differences were marginal, but once the amount of needed containers was added, then the total transportation cost effect was much higher for all containers used in this project. See Appendix 1 which demonstrates the prices and differences. This price difference was more visible, when comparing prices between shipping lines themselves. Some shipping lines gave the same prices for COC, SOC and ROC containers.
It is understandable that shipping lines will favor using their own containers in transit but on the other hand, all container are the same in usage and handling.

5.2 Components as break bulk shipment

Break bulk quotations were based on total volume of cargo that was estimated by engineering department as product was designed. See appendix 3 for price comparison between carriers. In addition to freight price for this break bulk shipment, some other costs were not visible, nor quoted. These were port charges on both loading and unloading ports. Also stevedoring costs were not mentioned in quotations.

5.3 A fully functional product shipped on multipurpose vessel

Charter vessel quotations were based on total volume of product. This information was checked by designer from dimension drawing of the complete product. See appendix 3 for price comparison between carriers. As in the break bulk shipment, some charges for charter vessel were not visible, nor quoted.

6 Safest transportation method for Konecranes' new product – Out-comes of the thesis

The answers to the thesis research question 2 are shown below. The case study was made based on a project and its cargo that had been already delivered. Collected data was based on principal questions, how the selected transportation methods are seen safe? While bearing in mind the specific product or component in transit as project cargo.

For container transportation, there were more negative outcomes than positive ones. Negative responses were more targeted to the actual shipping lines than to actual containers in transit. See appendix 5 for container SWOT -analysis.

For break bulk shipment, there were less negative outcomes than in container transportation. Negative outcomes were pointed more to scheduling and availability of the vessels. See appendix 6 for break bulk SWOT -analysis.

For charter vessel, there were almost as many negatives as positives outcomes. Since planning of these charter vessel shipments takes a long time, the planning phase of project shipments was seen as positive and negative in this transportation mode. See appendix 7 for charter vessel SWOT -analysis.

Based on all analysis together, there wasn't any clear transportation method that would have been more suitable than the other to use for this product. All these methods has got their good and bad points, when transporting project cargo.

7 CONCLUSIONS

Once all three transportation methods had been compared together, the most cost effective method was containers. All gathered data confirms this conclusion.

When you study all methods together, cost differences between cheapest and most expensive is more than double. So even, if there would be two products to be transported with containers, the cost would still be cheaper.

Since this shipment was part of project delivery, it must be understood that there are much more related issues to project management and handling of this cargo, than this study shows. This study has been done to view freight costs from the origin location to this projects final destination. Depending on the used delivery method in contract, there will be more costs and handling at the destination. Wherever these destination costs will end up, those are determine and agreed in the sales contract. Since it was determine in the beginning that cargo will fit into certain amount of containers, this study was based on one product being transported.

For this container shipment itself, in the appendix 4 is shown, that the cheapest one was not selected as a forwarding partner for this project. Project management decided that for this project it was best to select a logistics partner, which has a local office at the destination. This single matter had more weight on this issue than price, and when you look at this from the logistics point of view, it made sense.

Strong and motivated logistics partners can be the key for good outcome in project logistic. If you are delivering cargo to a country that is not familiar to you, and some of the logistics issues are unclear, it is best to select a partner that you can trust. By selecting a local logistic partner, it would make communication in your own language easier. This is not always possible! As mentioned earlier, the professional language of

logistics is full of codes, and interpreting them can be a challenge you don't need during your project shipments.

When you compare the best attributes of each transportation methods, it is fair to say, that there are no clear winner among them. All of them had good points and some had more bad points than others. Since this project must be viewed also from the products point of view, containers became the safest transportation method. Looking at the container transportation market, it can be seen that due to lower emission requirements and slower transit of ocean vessels, container shipments can be fairly unpredictable, when it comes to availability, cost and scheduling.

Project shipments and projects, in general are based on being able to deliver a product to buyer on time, in a right amount and in good condition. There are quite often difficulties of controlling all variables in logistics.

8 DISCUSSION

I personally really enjoyed doing this study, and I learnt a lot more through it. Although I've been working in operational logistics for many years, this study has given me more inside information to, how the overall logistic costs are formed.

Since projects are always based on cost, it was interesting to see in this delivered project, that some other attributes were considered more valueable than price. I've seen so many projects shipments that has been sole controlled by costs. Even if there would have been reasons to go with other partners, price was the main reason to reject this partner.

To take this study even further, next subject to study would be, what are the overall costs of logistics, if container shipment or break bulk shipments are used. With these transportation methods, there are still assembly work on site that needs to be done. Components are installed and assembled together and a complete fully functional product is then handed over to customer in their premises. These costs would be placed under site assembly work cost, since they are not relating directly to transportation costs, but it would be useful to know from the project management point of view. To see project delivery costs from beginning to end, is to study the costs for inbound, outbound logistics and final assembly site costs together.

Also another thing that could be enhanced, is how to interprite received freight qoutation in a far easier way than what it is now. See appendix 8 for a much simple document that would gather all numbers from forwarding partner in same format. This way it would be easier to understand to which part of the delivery process certain costs are related to. In this format forwarding agent can place their cost into right boxes by separating freight cost, origin and destination charges. If some of these cost are included to ex. freight cost, then a single value can be provided to this sheet.

In project logistics there is always something to learn, since global and local rules and regulations in many countries are continuestly changing. These changes are always close to logistics, if ex. import and export rules are updated, when countries laws of these procedures are modified. Therefore, what has been done previosly might no longer apply with the shipment you are planning to do now.

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APPENDICES

Appendix 1. Cost comparison for ocean freight between containers.

			SOC		Total	
	Ocean Freight cost	Forwarding company X	1250	USD/Cont	20000	USD
	Container type: 40' HC	Forwarding company Y	1150	USD/Cont	17250	USD
		Forwarding company Z	1250	USD/Cont	18750	USD
	1 product = 16 x 40' HC	Forwarding company A	875	USD/Cont	13125	USD
		Forwarding company B	1780	USD/Cont	26700	USD
			ROC		Total	
		Forwarding company X	1250	USD/Cont	18750	USD
		Forwarding company Y	1150	USD/Cont	17250	USD
		Forwarding company Z	1250	USD/Cont	18750	USD
		Forwarding company A	875	USD/Cont	13125	USD
		Forwarding company B	1780	USD/Cont	26700	USD
			COC		Total	
		Forwarding company X	1150	USD/Cont	17250	USD
		Forwarding company Y	1150	USD/Cont	17250	USD
		Forwarding company Z	1250	USD/Cont	18750	USD
		Forwarding company A	875	USD/Cont	13125	USD
		Forwarding company B	1630	USD/Cont	24450	USD

Appendix 2. Inland cost differences between 5 forwarding agents.

Company A - offer			Total			
Container price	2100	USD	33600	USD	29568	EUR
Pick up	530	USD	8480	USD	7462,4	EUR
BL fee	700	CNY/set	700	CNY	97,09	EUR
Export service fee	100	CNY/Cont	1600	CNY	221,92	EUR
OTHC	1350	CNY/Cont	21600	CNY	2995,92	EUR
MDF	550	CNY/BI	550	CNY	76,285	EUR
Telex release fee	650	CNY/BI	650	CNY	90,155	EUR
Handling	850	CNY/Cont	13600	CNY	1886,32	EUR

Company B - offer			Total			
Container price	10700	CNY	171200	CNY	23745,44	EUR
Pick up	0	USD	0	USD	0	EUR
BL fee	80	USD/Set	1280	CNY	70	EUR
Export service fee	0	CNY/Cont	0	CNY	0	EUR
OTHC	1300	CNY/Cont	20800	CNY	2884,96	EUR
MDF	0	CNY/BI	0	CNY	0	EUR
Telex release fee	500	CNY/BI	500	CNY	69,35	EUR
Handling	1030	CNY/Cont	16480	CNY	2285,776	EUR

Company C - offer			Total			
Container price	11000	CNY	176000	CNY	24411,2	EUR
Pick up	530	USD	8480	USD	7462,4	EUR
BL fee	700	CNY/Set	700	CNY	97,09	EUR
Export service fee	100	CNY/Cont	1600	CNY	221,92	EUR
OTHC	1350	CNY/Cont	21600	CNY	2995,92	EUR
MDF	550	CNY/BI	550	CNY	76,285	EUR
Telex release fee	650	CNY/BI	650	CNY	90,155	EUR
Handling	850	CNY/Cont	13600	CNY	1886,32	EUR

Company D - offer						
Container price	10750	CNY	172000	CNY	23856,4	EUR
Pick up		USD	0	USD	9723,12	EUR
BL fee	500	CNY/Set	500	CNY	109,6	EUR
Export service fee	0	CNY/Cont	0	CNY	0	EUR
OTHC	1185	CNY/Cont	18960	CNY	2629,752	EUR
MDF	0	CNY/BI	0	CNY	0	EUR
Telex release fee	450	CNY/BI	450	CNY	62,415	EUR
Handling	2020	CNY/Cont	32320	CNY	4482,784	EUR

Company E - offer			Total			
Container price	1980	USD	31680	USD	27878,4	EUR
Pick up	530	USD	8480	USD	0	EUR
BL fee	0	CNY/set	0	CNY	0	EUR
Export service fee	0	CNY/Cont	0	CNY	0	EUR
OTHC	0	CNY/Cont	0	CNY	0	EUR
MDF	0	CNY/BI	0	CNY	0	EUR
Telex release fee	0	CNY/BI	0	CNY	0	EUR
Handling	0	CNY/Cont	0	CNY	0	EUR

Appendix 3. Price comparison between carriers.

Break bulk carrier

Break bulk cost	Shipping line A	75	USD / CBM	85500	EUR
Total volume of cargo	Shipping line B	82	USD / CBM	93480	EUR
1140 CBM	Shipping line C	65	USD / CBM	74100	EUR

Charter vessel

Charter vessel cost	Shipping line A	lumpsum	77000	EUR
Total volume of cargo	Shipping line B	lumpsum	90000	EUR
8118 CBM	Shipping line C	lumpsum	95000	EUR
127 T				

Appendix 4. Total cost comparison.

		Total EUR	
Container	Comp A	59 998,09 €	
	Comp B	45 247,53 €	Cheapest
	Comp C	54 841,29 €	
	Comp D	54 240,07 €	Selected one
	Comp E	52 940,80 €	
Break bulk	Carrier A	85 500,00 €	
	Carrier B	93 480,00 €	
	Carrier C	74 100,00 €	
Charter vessel	Carrier A	77 000,00 €	
	Carrier B	90 000,00 €	
	Carrier C	95 000,00 €	Most expensive

Appendix 5. Container SWOT –analysis.

Container		
	S = Strengths	
	- modular transportation method	
	- safe	
	- cost effective for IG cargo	
	- not limited to time schedule	
	- possibilities for partial shipment	
	W = Weaknesses	
	- cost of oversize cargo (OOG cargo)	
	- availability in certain areas (special containers not available in every container port)	
	- variables in sailing schedules for liner vessels	
	- limited size and shape of cargo can be loaded into container	
	- possibilities for losses	
	- over booking of vessels	
	- human error in handling cargo	
	- risk of faulty handling	
	O = Opportunities	
	- many different types of container available	
	- scheduled routes for liner vessels	
	- possibility for partial shipments	
	T = Threats	
	- availability	
	- changes to routes	
	- fuel, CO_2, GRI effects to overall costs	
	- poor securing and lashing of cargo or containers	
	- many handling points along the way from loading to unloading	
	- rough handling at each load or unload point	
	- weather conditions (at port and during sea voyage)	
	Number of positive outcomes (S + O)	8
	Number of negative outcomes (W + T)	15

Appendix 6. Break bulk shipment SWOT –analysis.

Break bulk	
	S = Strengths
	- size, type and volume of cargo
	- any shape of cargo
	- flexibility in schedule
	- flexibility in routing
	W = Weaknesses
	- availability of optimal vessel for loaded cargo
	- available equipments on vessel or at port for loading
	- lack of optimal size vessel might cause prizing
	- cargo handling
	- cost effects if schedule changes
	O = Opportunities
	- variable cargo can be loaded
	- flexibility to set laycan window for loading
	- flexibitity to use non-commercial ports
	T = Threats
	- scheduling
	- cargo handling
	- risk of human error in loading or unloading
	- risk of losses
	- weather conditions (at port and during sea voyage)
	Number of positive outcomes (S + O) 7
	Number of negative outcomes (W + T) 10

Appendix 7. Charter vessel SWOT –analysis.

Charter Vessel	
	S = Strengths
	- all in one shipment
	- direct routing
	- limited handling for cargo
	- best solution for certain destinations
	- flexibility to use non commercial or green ports
	- engineering behind handled cargo
	W = Weaknesses
	- planning phase for shipment is long
	- availability of optimal vessel for loaded cargo
	- scheduling
	- loading preparation on vessel deck
	- loading or unloading conditions (strenght of quay for loading or unloading)
	- available equipments on vessel or at port for loading
	- know-how of cargo handling
	- engineering
	O = Opportunities
	- planning phase
	- variable cargo in one vessel
	- possibilities to influence planning phase
	T = Threats
	- loading or unloading conditions (strenght of quay for loading or unloading)
	- risk of losses very high
	- weather conditions (at port and during sea voyage)
	Number of positive outcomes (S + O) 9
	Number of negative outcomes (W + T) 11

Appendix 8. Sample for easier container transportation cost sheet.

	Project number:	N		Project name:		Name				
	Terms of delivery:	CIF NANTONG PORT								
	Approximate volume for seafreight tender									
SHIP. NO	SUPPLIER / PO	CARGO DESCRIPTION	40'	20'	ORIGIN CHARGES	DEST. CHARGES	OCEAN FREIGHT	TOD FROM SUPPLIER IF NEEDED	Comments	TRANSIT TIME, days
1	*KC FINLAND Hyvinkää*	*CRANE ELECTRICS*	*2*	*1*					*Malli*	
2	*CAVOTEC, Milano IT*	*CRANE ELECTRICS*	*2*	*1*				FCA 20054 Nova Milanese	*Malli*	
		TOTAL VOLUME:	1	1	0	0	0			
		TOTAL TEU's:	3							
	Container free time in destination is fourteen days, if any other timeframe is not agreed.									