

# TOTAL COST OF TRANSPORTATION

- A COST ANALYSIS OF CURRENT STEEL DELIVERIES IN COMPARISON TO FORWARDERS' QUOTES ON THE SINGAPOREAN MARKET

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**Linköpings universitet**  
**TEKNISKA HÖGSKOLAN**

Master's thesis LIU-IEI-TEK-A--10/00841--SE

Department of Management and Engineering

Division of Logistics Management

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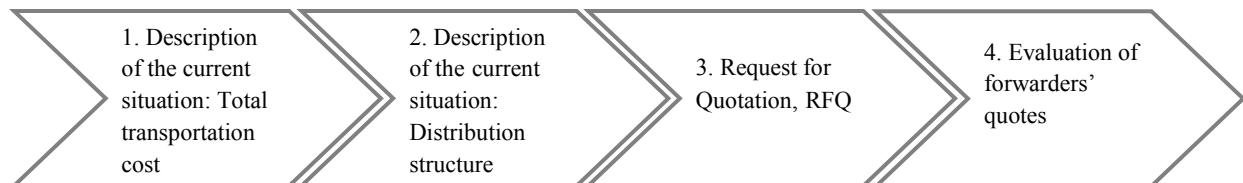
## EXECUTIVE SUMMARY

This master's thesis has been performed at ASSAB Pacific's head office in Singapore. ASSAB Pacific is a marketing company selling tool steel on the Asian market. The company has 16 subsidiaries spread all over Asia providing their customers with high quality tool steel and high customer service. The company runs one central stock in Singapore and 25 distribution centers throughout Asia. The transports between the central stock and the distribution centers as well as between the distribution centers and the customers are crucial in order to maintain high customer service in terms of lead time and delivery reliability. The dispersion of transported weights is wide and ranges from a couple of grams to several tons.

ASSAB Pacific wished to learn whether it would be possible to decrease the total transportation cost by contracting forwarding agents for designated deliveries. This thesis is focused on the local transports concerning the Singaporean market and thereby ASSAB Pacific's subsidiary in Singapore, ASSAB Singapore. The study is limited to the transports between ASSAB Singapore's distribution center and its end customers within Singapore. Hence, the purpose of the study is;

*“To map ASSAB Singapore's current distribution structure and its total transportation cost. Through a Request for Quotation the current situation will be compared to retrieved quotes from forwarding agents.”*

Throughout this study a four-step model adjusted for ASSAB Singapore has been used. The four steps included in the model are; *Description of the current situation: Total transportation cost, Description of the current situation: Distribution structure, Request for Quotation* and *Evaluation of forwarders' quotes*, see figure below.



Four-step model adjusted for ASSAB Singapore (modified Pewe et al., 2002)

The results of this study have shown that there is no cost saving potential for ASSAB Pacific on the Singaporean market if contracting forwarding agents. The current total transportation cost is significantly lower than the received price quotes from forwarding agents. The most economically beneficial price quote generates a total cost increase of 150 percent. In order to evaluate the credibility of the result a sensitivity analysis has been conducted. It showed that the result is not sensitive to the involved uncertainties, mainly due to the large cost gap between the current situation and the price quotes.

Furthermore, results illustrated the cost distribution between the fixed, variable and overhead costs included in the total transportation cost model developed for ASSAB Singapore. The fixed transportation cost is the significantly largest of the three. It composes 72 percent of the total transportation cost, whereas the variable and overhead costs compose twelve and 16 percent respectively. The overhead cost is surprisingly high while the variable cost is lower than expected. A conclusion drawn is that overhead costs should not be overlooked when calculating the total transportation cost in order to find a trustworthy result.

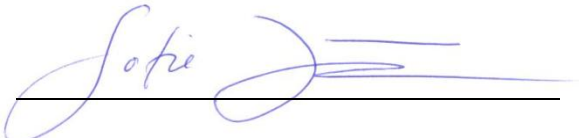
With consideration taken to the results, the conclusion of this study is that ASSAB Singapore should stay with its current distribution structure to avoid increased transportation costs. In this case an unexpected and drastic improvement of the delivery service cannot overrule cost as a decisive factor. It is important to understand that the result cannot be seen as general on the Asian market since the subsidiaries' markets differ. Transport conditions on the Singaporean market including congestion, infrastructure and distances differ from conditions on other markets in, for example, China and Indonesia. A recommendation towards ASSAB Pacific is therefore to conduct investigations on other geographically larger markets where the delivery lead time is longer and the need of consolidation of goods are more crucial than on the Singaporean market. It is believed that short delivery lead time and no need of consolidation are the main reasons why cost savings could not be reached when using forwarders for designated orders in Singapore.

## ACKNOWLEDGEMENTS

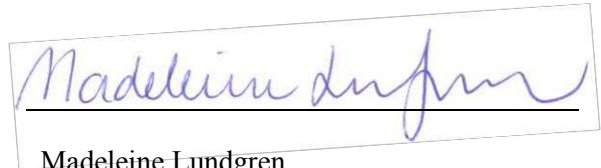
We would hereby like to thank ASSAB Pacific for the opportunity to conduct this master's thesis at the head office in Singapore. Furthermore, we would like to thank our colleges at ASSAB Pacific and ASSAB Singapore that have provided us with information and data throughout this study. We hope that you will have use of our work and the results of the study.

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Yours faithfully,



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## 1 INTRODUCTION

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*This chapter begins with the background of the study. In the background the studied issue that ASSAB Pacific Pte Ltd (in the following report referred to as ASSAB Pacific) faces is presented. The background leads to the presentation of the purpose. Thereafter a clarification of the constraints including directives from ASSAB Pacific and other limitations of the study are presented. As a last section, the report outline is declared.*

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### 1.1 BACKGROUND

ASSAB Pacific is a marketing company specialized in tool steel. With head office and central stock in Singapore the company serves the Asian market through 16 subsidiaries, including ASSAB Singapore. Through its subsidiaries ASSAB Pacific runs 25 distribution centers in 10 Asian countries employing more than 1 100 people.

ASSAB Pacific's products are delivered from the central stock to the subsidiaries' distribution centers where they are either cut into smaller pieces or delivered in their original size to the customers. Hence, an order can vary heavily in weight from a few grams to a couple of tons. Consolidations of customer orders are made when it comes to transportation but it sometimes happens that an order of only a few grams has to be separately delivered to a customer. This occurrence, as well as the location of the particular customer in relation to the distribution center and other customers, is believed to affect the total logistics cost for ASSAB Pacific.

Today the majority of company goods are transported to customers by in-house or subcontracted trucks. ASSAB Pacific, together with its subsidiaries, owns a total of 54 trucks and plan the delivery routes themselves. As the only exception, the Japanese subsidiary use subcontracted forwarding agents for all their transports. This type of transportation is today rare within other parts of the organization. A question whether the current mode of transportation with own trucks is optimal for all types of deliveries, considering service towards customers and total cost, has now been raised at ASSAB Pacific's head office. Forwarding agents have never been thoroughly investigated. ASSAB Pacific now wants to analyze if it would be beneficial to use forwarding agents for *designated orders*<sup>1</sup> instead of traditional truck deliveries on ASSAB Singapore's market. The studied part of the supply chain is between ASSAB Singapore's distribution center and its end customers.

### 1.2 PURPOSE

*The purpose of the study is to map ASSAB Singapore's current distribution structure and its total transportation cost. Through a Request for Quotation the current situation will be compared to retrieved quotes from forwarding agents.*

### 1.3 CONSTRAINTS

In order to perform a focused study it is important to set up delimiting boundaries. This study involves resource limitations in form of time and personnel, the information and data available at the company as well as directives given by ASSAB Pacific. The constraints that had to be made due to the mentioned limitations are discussed in more detail below.

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<sup>1</sup> *Designated orders* are orders weighing less than a fixed number of kilograms. This limit will be set to separate a substantial part from the total number of deliveries, see Section 5.4.

### 1.3.1 DIRECTIVES FROM ASSAB PACIFIC

ASSAB Pacific's total market around Asia is divided into smaller markets due to its 16 subsidiaries. The market, which has been chosen by ASSAB Pacific for this study, is ASSAB Singapore's market. In several of ASSAB Pacific's markets the production zones<sup>2</sup> are comparative to ASSAB Singapore's market since the end customers are located near each other. Due to the proximity to ASSAB Pacific and that ASSAB Singapore is representative for several other of ASSAB Pacific's markets around Asia, Singapore is regarded the most suitable market for the study.

The purpose does not include negotiation and evaluation of the cooperation in the transport purchasing process, why these steps have been delimited. These delimitations have foremost been made due to directives from ASSAB Pacific as they primarily want to see if cost savings can be made when using forwarding agents. Another reason is that it is not feasible to finalize the entire purchasing process due to the time constraint of the study. It is further considered more suitable for representatives at ASSAB Singapore to negotiate with potential forwarding agents as this is a first step in a future cooperation.

Furthermore, directives have been given concerning the type of transportation mode. The study will therefore only look into deliveries by truck or van and not railway or air freight, as the new transportation mode. The underlying reason for this is simply the prerequisites existing on the Singapore Island today. The island is very small, only 700 square kilometers, why air freight and train deliveries are not alternatives. Besides the distances to the customers, the existing infrastructure for train and air deliveries is not built up around ASSAB Singapore's customers. Hence, road deliveries with own trucks or forwarding agents are the most reasonable transportation modes.

### 1.3.2 SYSTEM LIMITATIONS

The total supply chain from ASSAB Singapore's suppliers to its end customers is shown in Figure 1. In accordance with the background of the study, the study is limited to "*the transport between ASSAB Singapore's distribution center to its end customers*", which only makes up the last part of the supply chain. Here, the transportation of steel from the distribution center to the end customer as well as additional material flow back and forth between the customer and the distribution center, are included. The material flow back and forth is caused by value adding services, heat treatments, offered by ASSAB Singapore to its customers, see Section 2.2.2 and 2.2.3. Other relevant parts for the study are administrative and value adding activities as well as the information flow between ASSAB Singapore's distribution center and its end customers.

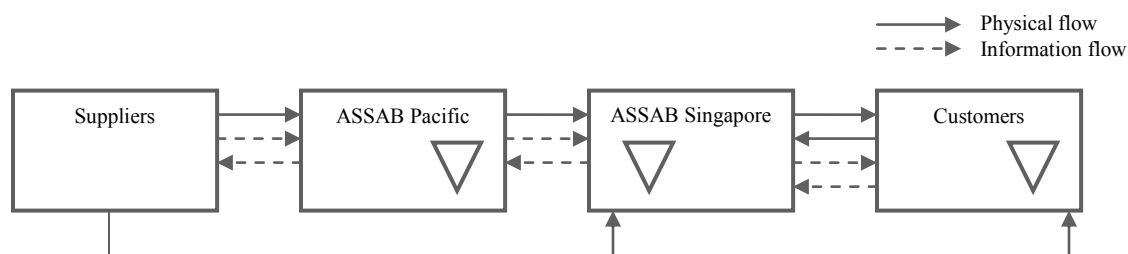


Figure 1. ASSAB Singapore's Supply Chain (modified Ong M., 2010)

<sup>2</sup> *Production zones* are areas where several customers are located.

The study will only take ASSAB Singapore's current demand into consideration. Changes in demand, caused by market fluctuations or changes in customer pricing and delivery service generated by an alteration in transportation mode, will not be taken into account. This since the study is based on historical data and not on forecasting.

#### 1.4 REPORT OUTLINE

The report begins by presenting the current situation for ASSAB Pacific and ASSAB Singapore. Here ASSAB Pacific is presented by explaining its group and company structure as well as its products and markets. This presentation is followed by the current situation for ASSAB Singapore with focus on the most relevant parts of the organization for this study, the transportation of steel and heat treatment goods to end customers. Thereafter an extensive theoretical framework follows. This chapter begins with definitions and explanations of different transportation perspectives and elements of the total logistics cost from these perspectives. It further comprises the delivery service elements and the trade-off between cost and service. It also discusses the focused transportation mode followed by the purchasing process of services with an extra focus on the construction of a *Request for Quotation, RFQ*. Finally, supplier selection criteria are discussed as well as the use of Activity Based Costing for cost distribution.

After the theoretical framework the task specification is presented. The specification further narrows down the purpose in order to reach suitable research questions for the study. The task specification includes a specification of the studied system as well as clarification of the steps in ASSAB Singapore's transport purchasing process. Later the methodology for the study will be declared. An explanation upon how the research questions developed in the task specification have been answered follows.

After explaining the methodology used in this study, the empirical results to the research questions are presented followed by an analysis including discussions about the current total transportation cost, the quotes received from forwarding agents as well as a discussion regarding the Singaporean market. Thereafter a sensitivity analysis follows, where possible sources of errors are evaluated. At last, conclusions drawn and recommendations towards ASSAB Singapore and ASSAB Pacific are presented including future steps for the concerned transportation and important lessons that have been made throughout the study.

## 2 ASSAB PACIFIC AND ASSAB SINGAPORE

*In this chapter ASSAB Pacific, as a company and a part of a global group, is introduced. The group and company structure are presented as well as the company’s products and markets. The succeeding section deals with ASSAB Singapore, one of ASSAB Pacific’s subsidiaries. Here the company’s products and markets are explained followed by a detailed elaboration of the company’s transportation structure including transportation mode, customer localization and delivery routes. The chapter is based on information gathered during interviews and presentations at ASSAB Pacific and ASSAB Singapore.*

### 2.1 ASSAB PACIFIC

ASSAB Pacific is a marketing company that originates from 1965. The company was launched by five Swedish steel producers wanting to enter the Asian market. After buying out the other four steel producers, Uddeholm AB later became the sole owner. The latest major change in the owner structure of ASSAB Pacific was made in 2008 when the company group was acquired by the Austrian company Voestalpine. Figure 2 illustrates the current ownership of ASSAB Pacific in a simplified manner. Unlike what the figure indicates Böhler Uddeholm only makes up about one percent of Voestalpine’s total turnover.

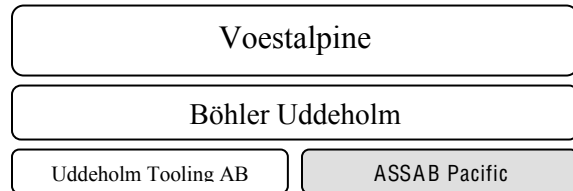


Figure 2. A simplified group structure of Voestalpine (modified Jensen, 2010)

Uddeholm Tooling AB is ASSAB Pacific’s sister company and its main supplier. Their products stand for approximately 80 percent of ASSAB Pacific’s total sales value. The remaining 20 percent are supplied from other companies within the group or from alien suppliers. ASSAB Pacific had a stable growth before the financial crisis 2008 when suddenly almost all markets declined. Asia is now both the largest market and the one with largest growth potential for the Böhler Uddeholm group.

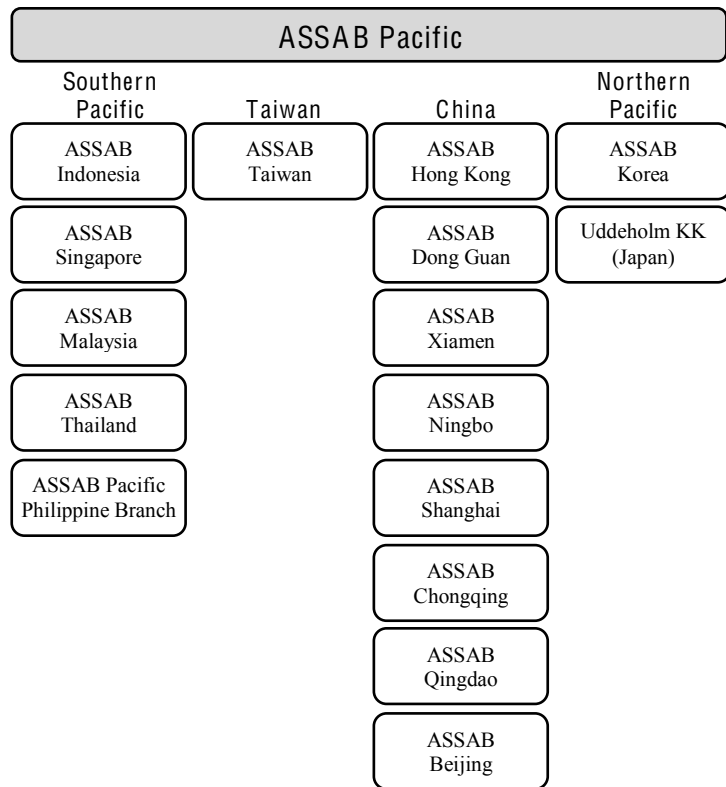


Figure 3. ASSAB Pacific and the company's 16 subsidiaries (modified Jensen, 2010)

ASSAB Pacific controls 16 subsidiaries illustrated in Figure 3. They are located in ten Asian countries and are divided into four market groups; *Southern Pacific, Taiwan, China* and *Northern Pacific*. Despite the groups, all subsidiaries report directly to ASSAB Pacific. The complete information flow, for example order placing and forecasting, between the

suppliers and the subsidiaries runs through ASSAB Pacific. In total, the company operates a central stock in Singapore, 25 distribution centers, 19 sales offices and employs more than 1 100 people.

2.1.1 PRODUCTS AND MARKETS

ASSAB Pacific has positioned itself as a high-end supplier of both premium and basic tool steel. They aim to offer their customers products of higher and more consistent quality than their competitors, something that contributes to their prices being higher than market average. They are also focused on high service when it comes to customer lead time and delivery reliability.

The majority of products forecasted to be sold during fiscal year 2009/2010 are tool steel for plastic molding, hot work and cold work, see Diagram 1. The products are sold in pieces ranging from a few grams to several tons. Steel is sold as round bars, cubes, rectangular blocks as well as thinner but wider rectangular plates. Besides the material, ASSAB offers the customers polishing and removal of protective primers. After the customers have produced their molds they can return them to ASSAB’s subsidiaries’ distribution centers for value adding activities in form of heat treatments, see Section 2.2.2 and 2.2.3.

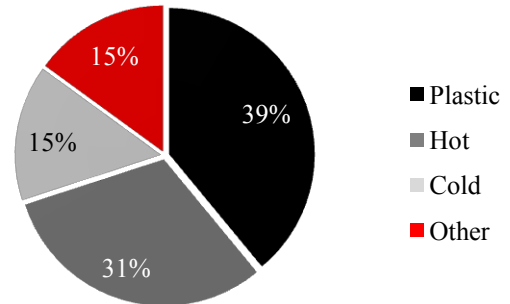


Diagram 1. Product segments forecasted 2009/2010 for ASSAB Pacific (Jensen, 2010)

ASSAB Pacific’s largest customer groups are within the industry of electronics followed by automotive and appliances see Diagram 2.

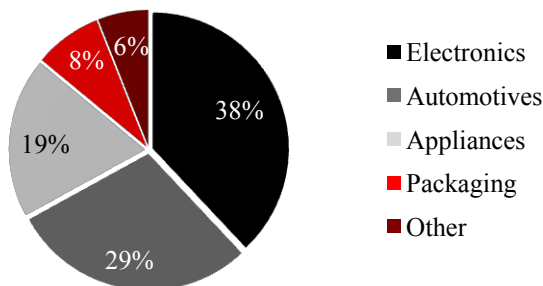


Diagram 2. Customer industry forecasted 2009/2010 for ASSAB Pacific (Jensen, 2010)

	PERIOD OF TIME	TOTAL SALES
Value	April-August 2009	SGD 103 million
	April-August 2008	SGD 147 million
	<i>% Reduction</i>	<i>30%</i>
Tonnage	April-August 2009	5 848 tons
	April-August 2008	8 847 tons
	<i>% Reduction</i>	<i>34%</i>

Figure 4. Total sales in value and tonnage 2008/2009 (Jensen, 2010)

In large, the Chinese market was the market growing the most before the financial crisis, while the tonnage in for example Singapore has declined during the last couple of years. The declining trend in Singapore can also be seen on other markets. It is not foremost due to increased competition on the market, but a result of producing companies, i.e. customers, moving to low cost countries such as China as well as a result of the financial crisis. The company’s total sales are tracked in tonnage and value. Both

declined with approximately 30 percent between 2008 and 2009 due to the crisis, see Figure 4. In May 2010 the company was once again back at its sales level before the financial crisis.

## 2.2 ASSAB SINGAPORE

ASSAB Singapore is one of ASSAB Pacific's 16 subsidiaries. The company employs 50 persons and had a turnover of 13.7 million SGD<sup>3</sup> 2008/2009; see the development of turnover in Diagram 3. ASSAB Singapore's fiscal year runs between April and March. The company's head office, production and distribution center is placed in Jurong, see Figure 5, in connection to ASSAB Pacific's central stock.

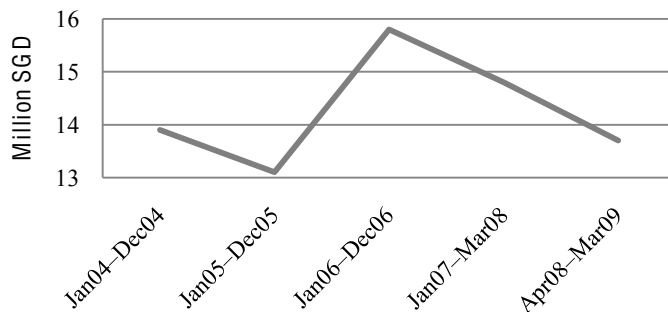


Diagram 3. The development of ASSAB Singapore's turnover from fiscal year 2004 to fiscal year 2008/2009 (Ong, 2010)

(In 2007 the fiscal year was moved and that year's figure was therefore calculated over 15 months. In this figure this particular year has been adjusted to an average to, in accordance with the other years, include 12 months of sales.)

### 2.2.1 PRODUCTS AND MARKETS

ASSAB Singapore's main sales arguments are that they are selling Swedish high-quality steel, offering their customers support and a high reliability within a global network. Besides cutting and grinding of material sold, ASSAB Singapore also offers its customers additional *heat treatment* of material and finished molds. The heat treatment is performed, for example, to strengthen or reduce stress of the material. ASSAB Singapore is the only steel provider on the Singaporean market that offers this service to its customers and they control approximately 50 percent of the Singaporean heat treatment market. The company heat treats materials from its competitors as well as approximately 50 percent of its own sales, see Diagram 4.

ASSAB Singapore has about 500 to 600 active *account customers*. The company also has cash paying customers. These customers are paying *cash on delivery* and some of them collect the material directly from the distribution center. If not collecting the goods themselves, these companies will suffer a surcharge of SGD 25 for the transport if the purchase is less than SGD 100. ASSAB Singapore's account customers are categorized into three groups, *A*, *B* and *C*, in

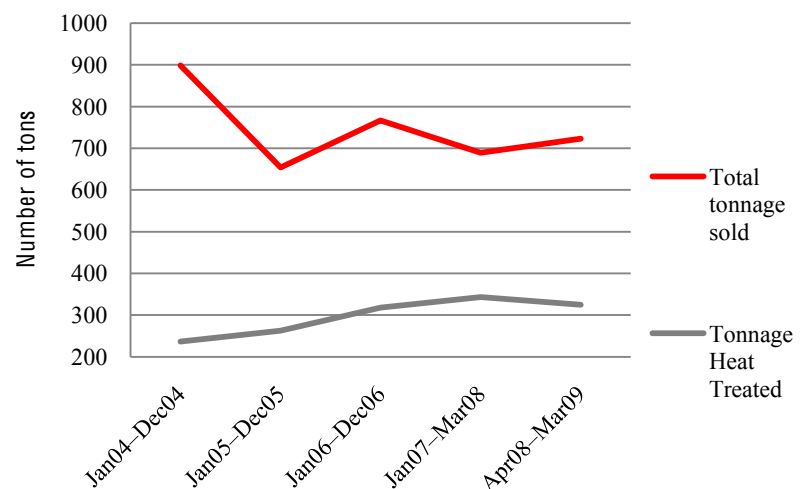


Diagram 4. ASSAB Pacific's total tonnage sold versus total tonnage gone through heat treatment (Concerning Jan07-Mar08 please see comment in previous figure.) (Ong, 2010)

<sup>3</sup> 1 SGD equals approximately 0.71 USD, 10-03-2010.



accordance with last year's annual sales value. The A-group comprises the company's 50 largest customers, together constituting approximately 70 to 80 percent of the company's total sales. This customer group is prioritized and thereby offered better service including shorter lead time. The A-group also takes part in an annual survey which covers customer's satisfaction. A follow-up of the survey is performed when a customer has stated its satisfaction as low.

The account customer base is presently rather steady and only a few new customers are signed annually. A customer that has not purchased any material during two years is taken off the customer account list. Though, this is only done after consulting with the customer why they have stopped buying from ASSAB Singapore.

ASSAB Singapore is dependent on the electronics industry which business area has grown over the last decade. According to ASSAB Singapore's Managing Director, the electronics companies in Singapore have moved from producing large appliances, such as TV screens, towards smaller devices such as cell phones. This has led to a decrease in the average size of the material sold by ASSAB Singapore. Further, foremost the electronics industry has increased its demand for short lead time. The electronics industry has very short product life cycles and its companies are constantly facing threats of fast moving plagiarizer when releasing new models on the market. Customers also demand high delivery reliability but more seldom than a short lead time. They often settle with knowing that the goods will arrive within a certain timeframe.

The majority of material sold by ASSAB Singapore is for plastic molding, which makes out approximately 55 percent of the company's total sales, see Diagram 5. The cold work materials constitute approximately 25 percent and 15 percent of materials sold are for hot work. Over the last five years the sales of cold and hot work has decreased while the material for plastic mold has increased.

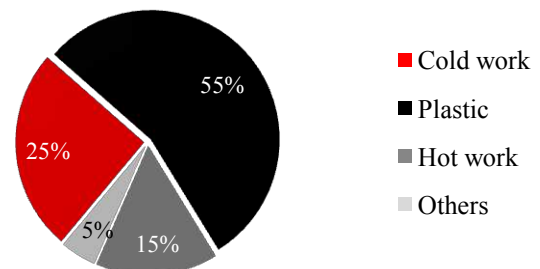


Diagram 5. Distribution of material types sold by ASSAB Singapore April 2008 to March 2009 (Ong, 2010)

### 2.2.2 TRANSPORTATION MODE FOR STEEL AND HEAT TREATMENT PRODUCTS

Several of ASSAB Singapore's customers are located close to each other whereas others are located more solitarily, but still it has to be considered that Singapore is a very restricted region of about 700 square kilometers. The transportation between ASSAB Singapore's distribution center and its customers is divided into three geographical regions, see Figure 5:

- *Town*
- *Ang Mo Kio (AMK) & Woodlands (WDL)*
- *Jurong*

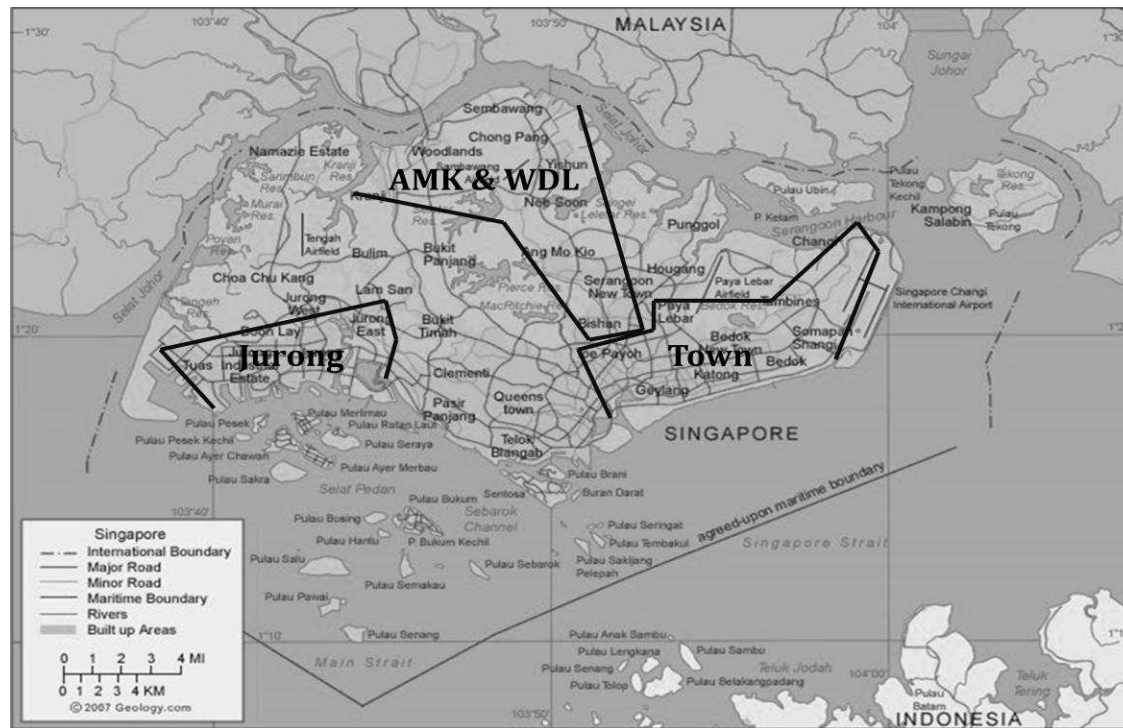


Figure 5. Geographical regions for ASSAB Singapore's transportations (Wee Kuong, 2010)

Besides the geographical division, the transports are also divided into two different sectors of application: *transportation of steel* and *transportation of heat treatment products*.

At present deliveries are performed by six vehicles out of which one ten feet truck is subcontracted. The other five are owned by ASSAB Singapore including three vans, one ten feet truck and one 14 feet spare truck. The steel transports are in total handled by two trucks. The subcontracted truck covers the Town region. Unlike ASSAB Singapore's own trucks, the subcontracted truck is operated by two persons, one driver and one attendant. The steel deliveries to Ang Mo Kio and Woodlands have been handled in cooperation with the heat treatment transports in that region. The company's ten feet truck covers the Jurong region and is driven by company drivers.

The heat treatment transports are performed by the three company-owned vans, one covering Town and one covering Jurong. The third van takes care of heat treatment deliveries as well as steel deliveries in Ang Mo Kio and Woodlands, as just mentioned.

### 2.2.3 TRANSPORTATION ROUTES AND PHYSICAL FLOW

The trucks deliver steel to the end customers five days per week, one round in the morning between 9:30 and 14:00 and a second in the afternoon from 14:30 till approximately 18:00. The time of the last transportation depends on the particular day's demand why the drivers sometimes have to work overtime. The three different regions are divided into different zones that the driver has to be in during a certain fixed period of time, see Appendix I. The routes within each zone are planned by the individual driver.

The heat treatment transports are made in two transportation rounds five days per week, one in the morning between 9:00 and 12:00 and a second in the afternoon between 12:45 and 18:00 see Figure 6. In

the morning the vans deliver heat treated products and at the same time collect products if needed from the customers. The products collected are weighed by the driver and thereafter keyed into SAP (ASSAB Singapore's business management software) by heat treatment operators. After unloading the vans they are once more loaded with heat treated products for the afternoon delivery. This afternoon delivery is longer and covers a larger area than the morning delivery. As for the steel transports, the different heat treatment deliveries are divided into different zones that the driver has to be within during a certain fixed time period, see Appendix I. In the same way, the heat treatment routes within the zones are planned by its respective heat treatment driver. Customers are recommended to inform ASSAB Singapore about collection of products one hour before the van enters their specific zone. If the customers' pick-up orders, despite this, are placed 30 minutes after the van has exited the zone Sales indoor will coordinate a potential collection with the respective heat treatment driver. If the delay exceeds 30 minutes managers have to be consulted before committing to the customer. All contact with the drivers, when out on their routes, is kept through walkie-talkies.

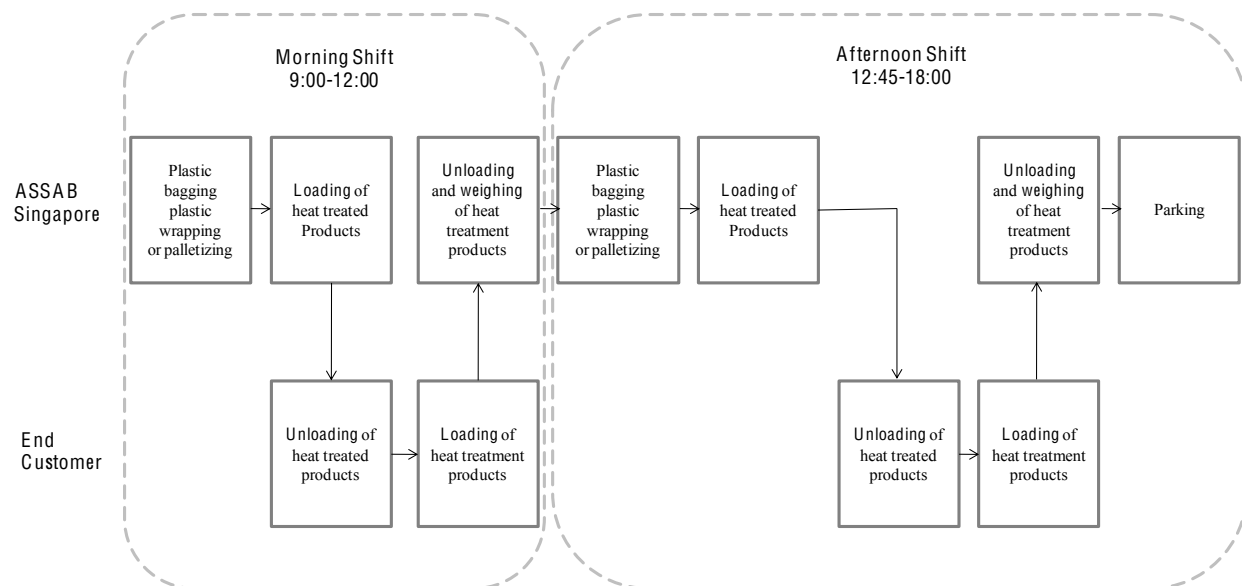


Figure 6. The delivery activities performed by warehouse personnel and heat treatment drivers (Leng, 2010)

When the heat treated products are finished and are to be delivered, all parts are verified in quantity before packed by heat treaters. Small parts are placed in plastic bags or arranged in a plastic container to not get lost. As a last step some parts are placed on pallets and wrapped with plastic film to hold them in place. Products are only covered by newspaper wrapping if it is requested by the customer. This is not a common request when most Singaporean companies focus on time and therefore do not want to waste time on taking the wrapping off when the goods arrive. The loading and unloading of trucks and vans are performed by the respective driver. The drivers aggregate orders that are to be delivered to the same customer as well as place the goods easily accessible on their truck or van according to their route.

Today the largest risk, concerning the transportation, is that the company has to rely on the drivers; that they will arrive to work the next day and that they will work efficiently throughout the day. As a back-up there is one employee working with heat treatment that has a driver's license and therefore can stand in as a driver if needed. Concerning the trucks and vans the company owns a spare 14 feet truck. This spare truck is used when the other trucks experience overload, if one of them has broken down or is away for

service, if the company needs to buy emergency spare parts or if an urgent order has been placed by an important customer.

The information and physical flow from received order until invoicing of steel and heat treatment passes between six subsystems. These six subsystems are *Sales indoor*, *Accounting and Administration*, *Machining*, *Cutting*, *Heat treatment* and *Delivery*, see Figure 7.



Figure 7. Subsystems included in the order handling process (Wee Kuong, 2010)

In Appendix II the activities affecting the information flow and the subsystems are illustrated. The heat treatment's information flow is more complex and is therefore further illustrated in Appendix III.

#### 2.2.4 ASSAB SINGAPORE'S DELIVERY SERVICE

Today ASSAB Singapore's delivery dependability is close to 100 percent, only a few per mille faulty deliveries are made. Products that are collected for heat treatment are delivered to the customer within one, or in some cases, two days. The number of days mostly depends on morning or afternoon transports, product sizes and the particular heat treatment process ordered. An order for special treatment of products prolongs the process and these products are normally delivered within two days. The guaranteed lead time also depends on the importance of the customer. The delivery time is documented by the driver and is filed for future reference, for example when there is a customer complaint. The steel delivery is checked every morning to account for any delivery that was not completed the day before. A report is prepared every morning by the delivery supervisor for Sales indoor with information of any failed delivery and the reason for the failure. Failures are normally due to two reasons. When using *cash on delivery* customer's checks or payments might not be ready. When this happens the driver reasons with the Sales indoor staff whether to release the goods anyway or to bring it back to ASSAB Singapore. A second reason for deliveries to fail is when the customer's factory is closed when the truck or van arrives. The failed deliveries will instead be delivered the following day. Failed deliveries are monitored monthly as a performance of the own and subcontracted steel deliveries. On an annual basis, the delivery performance is reviewed in the company's *management review meeting* to assess the performance of the subcontracted steel driver.

### 3 THEORETICAL FRAMEWORK

*This chapter presents the theories concerning this study. It begins by clarifying three different system perspectives of transportation. Two of these system perspectives are then used when presenting total transportation cost theories. The cost section is followed by a presentation of different delivery service elements and then the trade-off between cost and service is elaborated. After that, theories on how to choose transportation mode and carriers are declared. The transportation section is followed by definitions of the concept of services as well as service purchasing and logistics services theories. At last, the transport purchasing process is presented through an elaboration of its five process steps.*

#### 3.1 SYSTEM PERSPECTIVES FOR TRANSPORTATION

Concerning transportation, there are three different perspectives of the transport performance, *the transport supplier's perspective*, *the transport buyer's perspective* and *the transport infrastructure perspective*. When analyzing a transport system it is crucial to separate these perspectives from each other and to consider from what perspective the transport system in mind will be studied. (Oskarsson et al., 2006)

The transport buyer is simply interested in getting the goods delivered from one point to another to the lowest possible cost maintaining a high service level. The corresponding transport view from a transport supplier's perspective is usually more complex. The transport supplier has to consider consolidation of goods, routes, transshipments etcetera. Besides the transport buyer, the transport supplier is also dependent of the infrastructure which is necessary in order to perform deliveries. (Oskarsson et al., 2006)

In the following Sections, 3.1.1 and 3.1.2, the transport supplier's and the transport buyer's perspectives will be discussed in more detail.

##### 3.1.1 THE TRANSPORT SUPPLIER'S PERSPECTIVE

Traditionally, transport suppliers have worked with high *filling degrees* in the vehicles without customer orientation. Today, on the other hand, the transport market is driven by the customers' demand. (Oskarsson et al., 2006) There are several stakeholders in the transport business and the most common, according to Oskarsson et al. (2006) are:

- *The transport agent* who transmits the contact of a suitable transport supplier to the buyer
- *The forwarder* who transmits the contact of a carrier to the buyer as well as plans the transport
- *The carrier* who is responsible for the leasing of vehicles
- *The vehicle owner*
- *The driver*

In many cases, transport suppliers perform the work that corresponds to one or several of the stakeholders above. Producing companies usually have contact with a couple of transport suppliers in order to cover their needs of transportation. Different transport suppliers focus on different types of transports, for example air freight, parcel services and truck deliveries. Nowadays, more and more producing companies outsource the whole transport responsibility which has emphasized the growth of *third-party logistics*, TPL services. (Oskarsson et al., 2006) Independent of the type of transport, Oskarsson et al. (2006) claim, that the requirements from the buying company are clear: low costs, high level of service and short lead time. In order to fulfill the customer's requirements regarding cost, service and lead time, transport

suppliers are using different strategies. Low costs are achieved by, for example, having a high filling degree in the trucks. To achieve high service levels, transport suppliers perform regular transports at predetermined times. Short lead time is achieved by performing regular transports more frequently. The lead time, from a transport supplier's perspective, begins when the goods are picked up and finishes when they have reached the customer. (Oskarsson et al., 2006)

In order to work with predetermined and frequent transports as well as a high filling degree, large volumes are necessary. Most producing companies do not have sufficiently large volumes to perform their transportations efficiently. In fact, to create large volumes, consolidation of deliveries from several customers is sometimes necessary. This is the main business idea of transport suppliers. In Figure 8, the number of transportations without consolidation as well as the result of a consolidation of customers' deliveries via a terminal is shown. (Oskarsson et al., 2006)

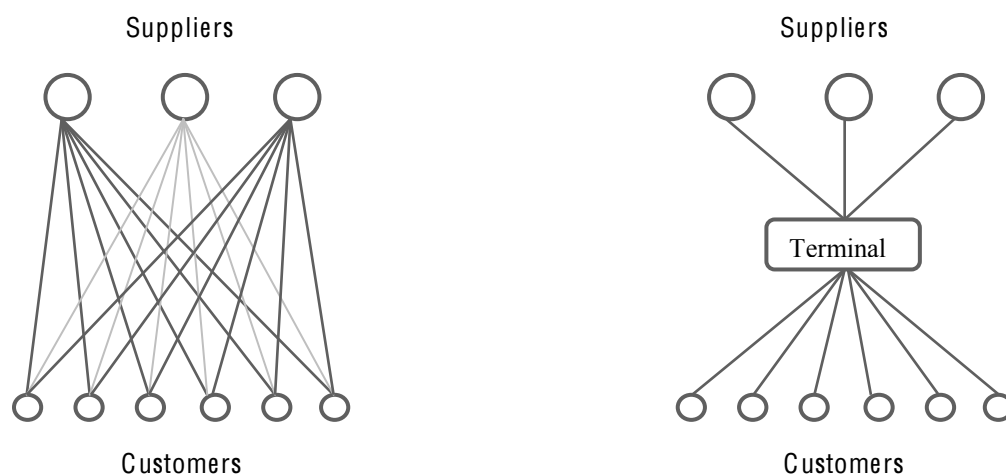


Figure 8. Transports with and without consolidations of customer deliveries (Oskarsson et al., 2006)

When consolidating customer deliveries via a terminal, the number of transports and thereby the transportation costs decrease significantly. Further, the delivery lead time increases due to the extra working moments that appear within the terminal. The total lead time, on the other hand, usually decreases since the delivery frequency increases and the waiting time thereby decreases. (Oskarsson et al., 2006)

### 3.1.2 THE TRANSPORT BUYER'S PERSPECTIVE

As mentioned earlier, the transport buyer's main requirements of the transport is that it should be performed at a low cost, with a high level of service and with a short lead time. Besides this, high flexibility regarding volumes and delivery dates is important to the buyer. This is due to the fact that the forward planning is usually very short when it comes to transport ordering. (Oskarsson et al., 2006)

In order to rationalize the material flow, many companies decrease their inventory levels. A consequence is lower order quantities and a higher delivery frequency. This affects the whole transportation system significantly. When decreasing inventory levels, the demand on transport increases. (Oskarsson et al., 2006)

## 3.2 TOTAL COST FROM A TRANSPORT SUPPLIER'S PERSPECTIVE

When analyzing the total cost of transportation one can, for example, use a transport supplier's perspective. Pewe et al. (2002) break the vehicle transportation cost, here referred to as transportation cost, down into *fixed* and *variable costs* whereas Rushton et al. (2006) adds *overhead costs*.

1. Fixed costs
2. Variable costs
3. Overhead costs

The fact that Pewe et al. (2002) do not include a category called overhead cost, like the one in Rushton et al.'s (2006), in their model does not mean that Pewe et al. (2002) exclude these types of costs. On the contrary Pewe et al. (2002) include overhead costs in their definition of fixed costs. The three following sections are named after Rushton et al.'s (2006) three categories of transportation cost elements.

### 3.2.1 FIXED TRANSPORTATION COSTS

*Fixed costs* are independent of the level of activity which means that it will remain the same even if the level of activity fluctuates (Rushton et al., 2006). According to Pewe et al. (2002) fixed costs compose about 65-70 percent of the total transportation cost. The vehicle itself is a large expense and, according to Rushton et al. (2006), most companies expect it to run between five to eight years. The working life of the vehicle depends on the usage. A local delivery vehicle which carries relatively light loads will last longer than a long-distance vehicle which is running a lot more every year. (Rushton et al., 2006) Besides the *vehicle depreciation*, Rushton et al. (2006) mean that *driver's license*, *vehicle insurance* and *driver's costs*, including salary, pensions, holiday pays, insurance etcetera, also must be included in the fixed costs. In turn, Pewe et al. (2002) claim that, besides the vehicle depreciation, vehicle insurance and the driver's cost in terms of salary, one has to consider other fixed costs such as *administrative costs*, *garage cost*, *the fixed vehicle tax* and *interest*.

### 3.2.2 VARIABLE TRANSPORTATION COSTS

The *variable transportation costs* vary in relation to a vehicle's activity i.e. the distance that it travels. Hence, the variable costs are here directly related to the distance covered by the vehicle. (Rushton et al., 2006) According to Pewe et al. (2002), the running costs compose about 30-35 percent of the total transportation cost. The cost of *fuel* is normally a significant portion of the running cost as a result of the high fuel consumption of commercial vehicles, the periodic shortages and heavy taxation. Besides fuel, running costs includes *oil and lubricants*, *tire wear*, *driver's overtime* and *repairs and maintenance*. (Rushton et al., 2006) In addition to the running costs presented by Rushton et al. (2006), Pewe et al. (2002) emphasize that *the running vehicle tax* which depends on the distance covered by a vehicle, must be taken into consideration.

### 3.2.3 TRANSPORTATION OVERHEAD COSTS

Compared to fixed costs and running costs, *overhead costs* will be classified as indirect costs because they do not relate directly to a specific vehicle. Instead, they should be borne by the whole fleet of vehicles. (Rushton et al., 2006) *Fleet overhead costs* consist of, according to Rushton et al. (2006), *back-up equipment* and *personnel* required to run a fleet of vehicles. *Business overhead cost* can be divided into transport departments and company administrative overheads. This includes *salaries for managers and transport planners*, *telephone*, *fax*, *rent*, *bank charges* etcetera. (Rushton et al., 2006)

### 3.2.4 A SUMMARY OF TRANSPORTATION COST MODELS

As earlier stated, the largest difference between Pewe et al.'s (2002) and Rushton et al.'s (2006) cost models is that Pewe et al.'s (2002) model does not separate overhead costs from fixed costs. Other differences between the two models are the levels of specification of the different cost elements, mostly concerning overhead costs. Rushton et al. (2006) specify the business overhead costs in several elements whereas Pewe et al. (2002) only break it down into administration cost and interest. The complete set of Rushton et al.'s (2006) and Pewe et al.'s (2002) vehicle transportation cost elements are illustrated in Figure 9 and Figure 10 respectively.

RUSHTON et al. – Total Transportation Cost		
FIXED COSTS	VARIABLE COSTS	OVERHEAD COSTS
<ul style="list-style-type: none"> <li>• Vehicle depreciation</li> <li>• Driver's license</li> <li>• Vehicle insurance</li> <li>• Driver's costs                             <ul style="list-style-type: none"> <li>Salary</li> <li>Pension</li> <li>Holiday Pays</li> <li>Insurance</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Fuel</li> <li>• Oil and lubricants</li> <li>• Tire wear</li> <li>• Driver's overtime</li> <li>• Repairs and maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Fleet overhead costs                             <ul style="list-style-type: none"> <li>Back-up equipment</li> <li>Back-up personnel</li> </ul> </li> <li>• Business overhead cost                             <ul style="list-style-type: none"> <li>Salaries for managers</li> <li>Salaries for transport planners</li> <li>Telephone and fax</li> <li>Rent</li> <li>Bank charges</li> </ul> </li> </ul>

Figure 9. Rushton et al.'s (2006) total transportation cost

PEWE et al. – Total Transportation Cost	
FIXED COSTS	VARIABLE COSTS
<ul style="list-style-type: none"> <li>• Vehicle depreciation</li> <li>• Vehicle insurance</li> <li>• Driver's costs                             <ul style="list-style-type: none"> <li>Salary</li> </ul> </li> <li>• Fixed vehicle tax</li> <li>• Administrative costs</li> <li>• Garage costs</li> <li>• Interest</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel</li> <li>• Oil and lubricants</li> <li>• Tire wear</li> <li>• Driver's overtime</li> <li>• Repairs and maintenance</li> <li>• Running vehicle tax</li> </ul>

Figure 10. Pewe et al.'s (2002) total transportation cost

### 3.3 TOTAL COST FROM A TRANSPORT BUYER'S PERSPECTIVE



Besides from a supplier's perspective, the total cost can also be analyzed from a buyer's perspective. From a buyer's perspective Oskarsson et al. (2006) emphasize that *total cost* is an important concept in logistics. By this Oskarsson et al. (2006) mean that all costs that are affected by a decision or a change in a certain instance will be taken into consideration. The reason is that a major portion of all decisions and changes will provide some increasing costs as well as some decreasing costs. When choosing between several alternatives it is therefore crucial to regard the change of total costs that each alternative provides. (Oskarsson et al., 2006)

Figure 11. Total logistics costs (Oskarsson et al., 2006)



Several authors have defined and presented the total cost concept from the transport buyer's perspective in many different ways. Most of the models are similar to each other even though smaller exceptions exist. (Oskarsson et al., 2006) Oskarsson et al. (2006) present a comprehensive total costs model, from the transport buyer's perspective, as in Figure 11. In the following sections Oskarsson et al.'s (2006) structure serve as a base.

### 3.3.1 INVENTORY CARRYING COST

*Inventory carrying cost* comprise, according to Oskarsson et al. (2006), the costs for tied up capital when having products in ownership but also the cost of risk. Risk costs involve the cost of insurance premiums, obsolescence and waste. Inventory carrying costs are calculated from the value of products carried in stock as well as the volume, in terms of quantity, in stock with respect to carrying charge. (Oskarsson et al., 2006)

### 3.3.2 WAREHOUSING COST

*Warehousing cost* arises when holding an inventory and it comprises the cost of buildings, personnel, equipments and internal transports. (Oskarsson et al., 2006)

### 3.3.3 TRANSPORTATION COSTS

According to Coyle et al. (2006) *transportation cost* is the admittedly largest cost in a logistics system. Oskarsson et al. (2006) also emphasize the importance to comprise the transportation cost within the total cost even though many companies are outsourcing their transports nowadays. Transport costs comprise all costs for administration and performance of transports. It includes both transports between the company's facilities as well as external transports. The transports within the facilities are not included since they are considered to be a part of the costs for holding the inventory, see Section 3.3.2. (Oskarsson et al., 2006)

### 3.3.4 ADMINISTRATION COSTS

*Administration cost* includes several larger and smaller costs which arise in correlation to the logistics flow. This involves cost for, among others, order entry, billing, payment of salary and economic follow-up. Administration cost is usually distributed per order since each order carries some administrative work, for example order placement and order entry. Distributed costs per order are usually named ordering cost. (Oskarsson et al., 2006)

According to Taylor (2008) administration costs can be divided into administrative logistics cost and affreightment cost. Affreightment costs are costs caused by logistics related functions performed by forwarder beyond the actual transportation cost. Accordingly, administrative logistics costs include corporate management and personnel who gives support in logistic related issues. (Taylor, 2008)

### 3.3.5 OTHER COSTS

*Other logistics costs* are costs beyond above mentioned cost items. Some examples of other costs are information, wrapping, material and logistic related costs which occur as a consequence of different logistical choices. These costs are related to each other and a change in one cost item often changes another. (Oskarsson et al., 2006)

### 3.4 DELIVERY SERVICE ELEMENTS



Figure 12. Delivery service elements (Oskarsson et al., 2006)

Lumsden (2006) define *delivery service* as a general concept that states a company's performance towards its customers. Compared to logistics cost, Lumsden (2006) means that it is challenging to measure the economic effect of good delivery service. Hence, the challenge is to determine a suitable level of service when the relationship between income and service is unknown. Companies have to determine a level that they want to achieve in consideration to their competitors. Most important is to find a level which corresponds to customers' requirements and expectations. Different customers have different requirements of delivery service and the offered level of service should be adjusted on the basis of these requirements. (Lumsden, 2006)

According to Oskarsson et al. (2006) delivery service is a concept depending on activities before and after the delivery. Before delivery it is crucial to be clear towards the customer about what level of service they can expect. It is also important to be flexible to different customers' needs. At the delivery moment it is essential to fulfill the service promised when the customer placed the order. Another central part is to deliver the right quantity without errors to the right address. After delivery the supplier's main responsibility is to provide the customer with spare parts. If a supplier can handle all these different activities it believes to offer satisfying service. (Oskarsson et al., 2006)

The concept delivery service comprises, according to Lumsden's (2006) and Oskarsson et al.'s (2006) definitions, the elements *lead time*, *delivery reliability*, *delivery dependability*, *fill rate*, *information* and *flexibility*, see Figure 12. Together they compose a comprehensive picture of the definition of service. Which elements being the most essential vary depending on customer and type of business. (Oskarsson et al., 2006) The delivery service elements are discussed in more detail below.

#### 3.4.1 LEAD TIME

*Lead time* or delivery time comprises the time from order placement until the product is received by the end customer (Oskarsson et al., 2006). It includes activities such as order entry, order handling, planning, construction, manufacturing and delivery (Lumsden, 2006). According to Pewe et al. (2002) the lead time demand is one of the most important criteria of how the physical distribution should be dimensioned. Further Pewe et al. (2002) emphasize the high effect the lead time has on the total distribution cost.

Customers are usually only interested in total lead time. On occasions when customers' requirements of short lead time cannot be fulfilled by production, *finished goods inventory* (FGI) must be used. (Lumsden, 2006) The strategy used when handling FGI is called *make to stock* (MTS) and is not based on real orders; instead products are manufactured according to forecasts based on future demand (Greene, 1997). MTS is used to decrease the total lead time to end customer by removing the production lead time (Hill et al., 2009). Pewe et al. (2002) add that the lead time can be further decreased by establishing reliable transport and information systems. As an example of this, Lumsden (2006) states that distribution centers can be used in order to reduce the transportation lead time, and thereby also the total lead time, to end customers.

### 3.4.2 DELIVERY RELIABILITY

Delivery reliability means reliability in lead time, i.e. how precise in time the supplier is able to deliver the product in comparison to what was promised when the order was placed (Oskarsson et al., 2006). Delivery reliability is often prioritized higher than lead time when it comes to materials for production. The utility of, for example, *just-in-time*<sup>4</sup> (JIT) and reduced product inventory have increased this priority since it is now even more important that products are delivered on time. (Lumsden, 2006)

### 3.4.3 DELIVERY DEPENDABILITY

Delivery dependability specifies in what extent a product is delivered in right quantity as well as in right quality (Oskarsson et al., 2006; Lumsden, 2006). As for the delivery reliability, the delivery dependability is also getting more important as a consequence of JIT deliveries. Of the same reason, delivery dependability is more crucial when it comes to complementing products. The products that are to be connected are useless without the connecting product. (Lumsden, 2006) Most customers are expecting the delivery dependability to be almost perfect (Oskarsson et al., 2006). According to Wetzels et al. (2000) several Asian distributors find that delivery dependability is the most important element of service.

### 3.4.4 AVAILABILITY

According to Oskarsson et al., (2006), the availability defines the percentage of the number of order lines or total orders that can be delivered directly from existing inventory to customer after order placement. For products which are manufactured upon order, the availability cannot be measured (Oskarsson et al., 2006). In turn, Lumsden (2006) defines availability as *degree of service* which is only applicable on inventory products which are directly connected to the company's safety stock.

### 3.4.5 INFORMATION

According to Oskarsson et al. (2006) the information exchange is essential when the demand for shorter lead times increases. From a supplier's perspective it is important to get order information as soon as possible in order to plan the production. Whereas, from a customer perspective the most crucial is to know what level of service the supplier is able to offer. Anyhow, both parts are in need of information from each other why it is important to have an efficient information flow. (Oskarsson et al., 2006)

### 3.4.6 FLEXIBILITY

Flexibility as a service element means that an estimate is performed in order to find out how flexible a supplier is when it comes to customers' specific requirements. These requirements can involve, among others, reduced lead time or requests about specific wrapping. (Oskarsson et al., 2006) Flexibility can also, according to Lumsden (2006), comprise the capability to maintain the reliability and dependability in deliveries by finding new solutions to different problems and distractions. Customers' requirements of flexibility increase continuously and in many cases it is an important competitive factor (Lumsden, 2006).

## 3.5 THE TRADE-OFF BETWEEN TOTAL COST AND DELIVERY SERVICE

Delivery service has become an important factor for supplier and purchase decisions (Wetzels et al., 2000). Therefore, companies which are designing or redesigning their supply chain face simultaneous demands of improved service and reduced cost (Shen et al., 2005). According to Oskarsson et al. (2006) the objective of logistics is to obtain a high level of service to a low total cost. In order to do so it is

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<sup>4</sup> *Just-in-time* is "... production of only necessary flow units in necessary quantities at necessary times." (Anupindi et al., 2006)

important to find the right balance between logistics cost and delivery service, see Figure 13. This balance can be seen as a trade-off between cost and service. Shen et al. (2005) mean that it also is an *inter-service trade-off* between different delivery service elements, as the elements are partially integrated. This trade-off is also important to consider when taking supply chain decisions (Shen et al., 2005).

Generally, the level of delivery service is settled before the total cost, and on the basis of this particular level companies are trying to reduce their costs. Companies may also be forced to maintain a specific level due to requirements from the market and the competitive situation. (Oskarsson et al., 2006) According to Shen et al. (2005), building a decision-support system that integrates cost elements with service goals is a big undertaking for a company, but doing so can lead to competitive advantages on the market.

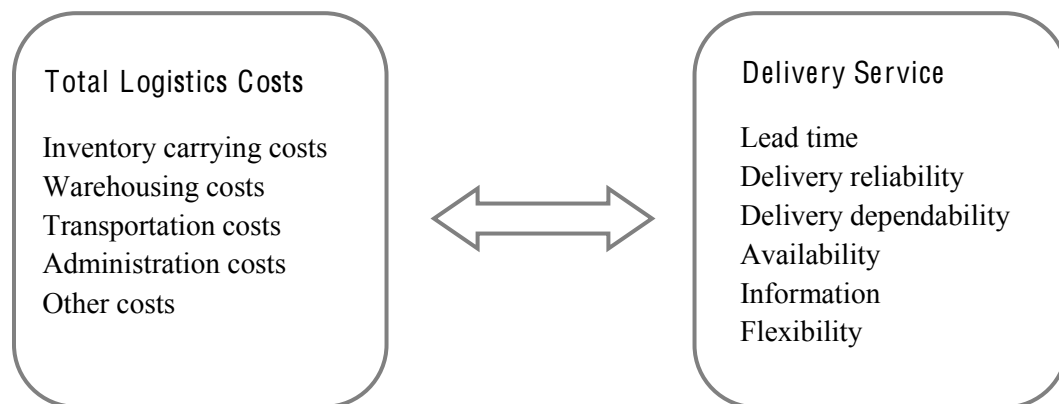


Figure 13. The trade-off between total logistics cost and delivery service (Oskarsson et al., 2006)

### 3.6 CHOOSING TRANSPORTATION MODE

According to Wong (2007), traditional transportation mode selection has been focused on finding the alternative that generates the lowest transportation cost. Further, Wong (2007, page 69) means that current supply chain management's goal for this matter is to obtain "... *the cheapest option that meets service requirements as well as production*". The selection of a specific carrier has to be made in two steps. First different transportation modes should be compared to each other according to a company's cost and service goals, thereafter the best solution within the chosen mode should be identified. (Coyle et al., 2006)

According to Coyle et al. (2006) there are five transportation mode selection factors:

1. *Transportation cost* including the rate charged by the carriers in a particular mode as well as the charges assessed by the carriers in a mode for additional services.
2. *Transit Time* and *Transit Time Reliability* affects the total logistics cost through the need of different levels of inventory and safety stock levels.
3. *Accessibility* refers to the ability of the transportation mode to provide the service between two destinations.
4. *Capability* concerns the ability of the transportation mode to provide the unique service and equipment required by the user.
5. *Security* refers to the indirect transportation cost derived from damaged or lost goods.

Coyle et al. (2006) further state that when it comes to carrier selections, focused factors are *cost, transit time and reliability* as well as *security*. “*Reliability of transit time is the most important carrier selection factor followed by transportation rate, total transit time, willingness to negotiate, and financial stability of the carrier.*” (Coyle et al., 2006, page 414)

Wong (2007) states that local companies in Hong Kong that have small and infrequent consignments mainly prefer to organize their own transport to their customers. Further, companies with large and frequent deliveries rather outsource their transports to a third-party logistics provider. Though, it has been shown that companies in Hong Kong occasionally switch to different modes of transportation to achieve higher efficiency due to the proximity to their customers. (Wong, 2007)

### 3.7 TRANSPORT PURCHASING PROCESS

According to Pewe et al. (2002) it is crucial to regard the whole system when purchasing transport services. The preparations for transport purchasing are, in many companies, not of the same quality as for regular goods purchasing. The *value of the goods per tonnage, number of cubic meters, density of the goods, transport frequency and average order size* are factors that the companies generally have poor knowledge about. When performing accurate preparations for the transport purchase, there are significant potential to cost reductions. In order to achieve the knowledge necessary to reach cost reductions, companies can either enhance resources to that part of the organization that handle the transport purchasing or use qualified consultants services within this area. (Pewe et al., 2002)

Pewe et al. (2002) claim that factors affecting a company’s quality and total costs for the physical transportation system are, among others, the *transportation mode, the physical distribution system, wrapping, number of transshipments*. Pewe et al. (2002) further state that it is essential to also consider other factors besides *total cost* when choosing forwarder or carrier, namely *reliability, dependability, flexibility and resources*.

A cost analysis, when purchasing transports will include a decision basis, based on facts where quotes from suppliers can be evaluated (Pewe et al., 2002). According to Pewe et al. (2002) the purchase of transports can be divided into four steps, *Description of the current situation, Request for Quotation (RFQ), Evaluation of supplier’s quotes and Negotiation and contracting*. Andersson (2007) states that a fifth step, *Evaluation of the cooperation*, should be included in the purchasing process of logistics services. Therefore, Pewe et al.’s (2002) process of a transport purchase has here been extended with this fifth and additional step, see Figure 14. In accordance with the directives, see Section 1.3.1, step four and five in the transport purchasing process have been delimited and thereby been placed in Appendix IV.

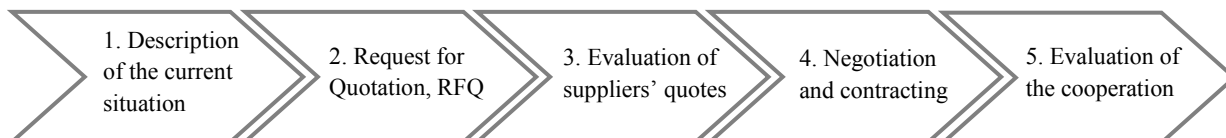


Figure 14. A modified model of Pewe et al.’s (2002) transport purchasing process. Fifth step retrieved from Andersson’s (2007) purchasing process for logistic services.

In the following sections, two main references will be used. Pewe et al. (2002) discuss purchases of transports, while Andersson (2007) describes purchases of logistics services. Andersson’s (2007) theories are in many aspects relevant for purchases of transports as well, since outsourcing of transports is a kind of logistic service purchase. Pewe et al.’s (2002) model for purchases of transports will as explained stand

as the process base in the report, whereas Andersson's (2007) and other authors relating theories will be integrated in Pewe et al.'s (2002) model.

### 3.7.1 DESCRIPTION OF THE CURRENT SITUATION

By thoroughly going through the transport purchasing criteria a better basis for a future decision is achieved (Pewe et al., 2002). Andersson (2007) means that a company's strategies, that have a connection to the logistics operation, have to be identified as well as the operations themselves and their corresponding costs. If considering outsourcing transports for the first time, Andersson (2007) highlights the importance of making sure that the outsourcing is in line with the company's overall objectives and strategies and that it will not be an obstacle for future structural changes or rationalizations of the logistics operations. Pewe et al. (2002) identify the description of the current situation as the most important and time consuming part of the transport purchasing process.

According to Pewe et al. (2002) the basic principle of assessing the current situation is for a reality-based report to be produced. This report should include the real delivery structure of the company's different flows throughout a year. It is essential that all concerned suppliers, customers and products are represented in this delivery structure. This information is the same as the information needed for pricing, price controlling and for deducting the service. (Pewe et al., 2002) Pewe et al. (2002) add that product information or other information that the company wants to analyze in addition to the transport data ought to be collected during this phase.

A current situation analysis that gives information about current costs and delivery structures should both indicate the totality as well as specific details. The analysis should for example cover the following areas (Pewe et al., 2002):

- How are the goods sold on different markets?
- Delivery conditions
- Preliminary purchasing plan
- The density of goods
- The suppliers' or customers' localization, description of the goods and lead time demand
- How the goods are packed and handled
- Separate shipments and their individual costs
- Total declaration of shipments and total costs

After identifying the current situation, selected and edited parts should be used as a basis for the *Request for Quotation*.

### 3.7.2 REQUEST FOR QUOTATION

A complete *Request for Quotation*, (RFQ) should give the transport suppliers all the information that they need to construct a quote. The RFQ should be constructed in such a way that a completely new supplier should have the same opportunity to succeed with its quote as a supplier that has been contracted before. The suppliers should be given at least three to four weeks to place their quote, enabling a thorough analysis. (Pewe et al., 2002) According to Rushton et al. (2007) there are four main objectives for constructing an RFQ from the buying company's perspective:

1. To provide a specification of business requirements enabling *selecting a supplier in a structured and standardized way*. The company's business and operational requirements must be stated in a clear manner using suitable data and descriptions.
2. To *facilitate an objective comparison* of incoming quotes. This can be achieved by standardizing the response format. In turn this decreases the risk for misunderstanding quotes and making wrong interpretations. It is also easier to compare and evaluate several equally constructed quotes.
3. To *maintain unbiased information flow* out to all quoting companies. The goal ought to be to deliver the same information to all companies, including the information released after the RFQ. The quotes should all be constructed from the same information.
4. To *establish total confidentiality rules*. All the information and data from the buying company as well as the information and data coming back from the different forwarding agents should be handled with confidentiality.

Fria (2005) adds that using an RFQ is a good way to clearly define the scope of the project for everyone involved.

#### 3.7.2.1 CONSTRUCTING AN RFQ

Rushton et al. (2007) provide a list of data and information that they believe ought to be included in the RFQ, see Appendix V. The data that is provided through the RFQ has to be on an appropriate level of detail to allow the forwarding agents to do proper analysis of the resources required and to identify and calculate associated costs (Fria, 2005). Besides data, the RFQ has to clearly state what type of pricing and charging structure, if any, that should be used by the supplier. The actual data requirements and contents of the RFQ vary according to operations and contract requirements. The numerical part of the quote will be the quantitative criteria of the evaluation. (Rushton et al., 2007)

Pewe et al. (2002) divide the RFQ into the following sections:

1. A short and informative *introduction* of the company, describing customer and/or supplier distribution structure. If the company is *International Organization for Standardization*, ISO, or *Total Quality Management*, TQM, certified this should be stated. Further, if any of these certifications concerns transportation a corresponding document can be attached.
2. A concise *goods and product description* including descriptions of the wrapping and transportation package. If it exists any specific handling regulations these should be clarified in this section.
3. A clarification of the *transport system* including geographical coverage, lead times, express service, booking and goods notification routines, capacity, the load, carrier's quality and type, system for quality measurement etcetera.
4. The section of *delivery statistics and structures* includes the edited delivery structure from the current situation analysis. The delivery structures should be individually presented per relationship and include delivery terms.
5. The offered *prices and terms* should run for a determined period of time, usually twelve months. If the supplier finds reasons to adjust these prices he ought to confirm this in his quote. The most

common reasons for adjusting the price during the determined time period are oil, diesel and currency fluctuations. The supplier should be asked to name the respective price level that the price quote is based on and to attach a “key” that provides the limits for adjustments. The quote prices should be given per net transport and additional costs should be noted. Besides this, the quote should also include calculations for break-points, terms for bulk-size etcetera. Administrative costs for example *handling charge, costs for customs, pallet cost* should be declared separately.

6. The section of *administrative routines* includes demands or wishes for payment terms and a declaring environmental report.
7. In the last section called *other*, the transport supplier should be asked what insurance agreements that will be used. It is important to check with the own insurance company that a full insurance coverage is present. Besides the insurance question this section can also include requests for track-and-trace declaration as well as routines for reclamations. Further the contact details for complementing questions should be stated in this section.
8. *Appendixes* that should be attached are company and product descriptions, delivery structure and extracts from the company’s quality manual if any.

The complete RFQ should be sent to different suppliers in order to receive their individual quotes. According to Van Weele (2008) it is common practice to identify three to five prospective suppliers and ask them for their quote. Sink et al. (2007, page 179) have found that “... *industrial buying teams usually consider six to eight potential suppliers and seriously evaluate two or three ‘finalists’.*”.

Rushton et al. (2007) state that a clear structure for the responding quotes should be presented in the RFQ to ensure that the different quotes will be possible to compare to each other. Concerning the structure, Pewe et al. (2002) underline that some companies go too far with structuring the RFQ and that this might hinder suppliers to be innovative when placing their quote. The quotes should then be evaluated against for example set goals or current costs. Today there are many companies that, besides the numerical responses, ask for detailed information in, for example, areas about *contract management and supervision, information systems, security, insurance, penalties for premature termination of contract and invoicing and payment*. This detailed information allows a more qualitative assessment to take place, an assessment to complement the quantitative analysis of the quotes. (Rushton et al., 2007)

### 3.7.2.2 SUPPLIER SELECTION CRITERIA

To decide which suppliers that should receive a Request for Quotation, buying companies can use different selection criteria. (Andersson, 2007) Jain et al. (2009) state that a supplier selection involves two main tasks; the process of evaluation and assessment as well as aggregation of evaluation and assessment to make a choice. The evaluation and assessment task requires the identification of decision attributes, *criteria*, on the basis of which the potential suppliers are to be assessed. The next requirement is to assign weights to criteria to indicate the relative importance of each criterion to the supplier evaluation and assessment. (Jain et al., 2009)

According to Jain et al. (2009), supplier selection decisions are complicated due to the fact that various criteria must be considered in the decision-making process. Jain et al. (2009) further state that the analysis



of criteria for selecting and evaluating the performance of suppliers has been in focus by many researchers and purchasing practitioners.

The most common reference dealing with supplier selection problems is Dickson (1966). The finding of Dickson's study was 23 weighted selection criteria, see Appendix VI. According to Dickson (1966), the most significant criteria are *quality* of the product, *on-time delivery*, *performance history* of the supplier and *warranty policy* used by the supplier. A similar study was performed by Weber et al. in 1991. According to this study, *net price*, *delivery* and *quality* were the most significant supplier selection criteria (Weber et al., 1991).

Pewe et al. (2002) focus on transport purchases, why this theory is regarded as a suitable delimitation of Dickson's (1966) and Weber et al.'s (1991) theories. The preparations before a transport purchase should, according to Pewe et al. (2002), include a *supplier profile analysis*. The purpose of the supplier profile analysis is to find a profile for a desirable supplier. The profile is later used as an important selection criterion when selecting supplier among incoming quotes. (Pewe et al., 2002) Examples of important selection criteria for transport purchases that should be included in the supplier profile are *reliability*, *capacity flexibility*, *geographical coverage*, *environmental considerations*, *IT awareness*, *cost efficiency*, *quality in operations*, *financial stability*, *tracking systems*, *historical performance*, *transport system knowledge* and *security transport system*. (Pewe et al., 2002)

### 3.7.3 EVALUATION OF SUPPLIERS' QUOTES

According to Pewe et al. (2002), the evaluation will present the *financial outcome* for each quote, i.e. the total cost on annual basis compared to the current situation. The cost of different scenarios should be compared on *delivery level*, *per transport relation* and *in total on annual basis*. (Pewe et al., 2002)

Andersson (2007) states that the most essential selection criteria when evaluating and selecting a supplier for a logistics service are *price*, *service* and *competence*. Price and service are constantly reoccurring in all steps of the purchasing process and they are without a doubt the most important selection criteria. In the selection step it is crucial that a complete total cost calculation of the current situation has been made to compare to the suppliers' quotes. (Andersson, 2007) Andersson (2007) states that companies, not having made a proper total cost analysis, often perceive the suppliers' quotes as high since they have overlooked hidden costs such as for example overhead costs. The cost and service criteria are complemented by the supplier's competence, since the competence criterion is a prerequisite in order to achieve service and cost objectives. (Andersson, 2007)

The evaluation will result in a base for negotiation, where the company clearly can see the effects of different prices and changes in conditions on every specific delivery for each flow of goods. The cost efficiency will be declared on several levels and the quality and service will be economically evaluated. After this first selection, the company should call for the first transport negotiation. As a base for the negotiation the company should now have both a qualitative and a financial preparation. (Pewe et al., 2002)

## 3.8 ACTIVITY BASED COSTING

In recent years, the production industry has experienced increased competition and higher demand concerning quality and shorter lead times (Gunasekaran et al., 1999b). Further the assortment range has become wider and the product lifecycles have decreased (Gerdin, 1995). These changes have, according

to Gerdin (1995), lead to a change in producing companies cost structure. Before, a large part of companies' costs were compiled by direct labor and direct material cost (Gerdin, 1995). Today an increasing part of the costs consists of technology costs due to more automated productions (Gunasekaran et al., 1999b). At the same time overhead costs have augmented since companies have had to invest increasingly in areas such as research and development, R&D, production planning and sales. Due to these structural cost changes, traditional allocation costing methods of a product's cost may sometimes be deceptive. The traditional allocation costing are particularly misleading when a company's products have different cycle time, spend different amounts of direct resources per unit and/or when volume independent expenditures constitute a large part of the total expenditure. To enable calculations of products' use of a company's resources Activity Based Costing, ABC, has been developed. (Gerdin, 1995)

All activities performed within a company supports production and distribution of a company's products (Gerdin, 1995). Therefore Gerdin (1995) argues that all cost should be considered as product costs. When using ABC, expenditure should be divided in accordance with the products' claim on the company's different activities. Activities consume resources such as work and material in order to add value to the company's products. (Gerdin, 1995) When considering usage of ABC a company must look at the trade-off between the high costs of measurements, much due to the high time consumption, and the increasing benefits that ABC could generate (Gunasekaran et al., 1999b).

### 3.8.1 DESIGN OF AN ABC SYSTEM

Gunasekaran et al. (1999b, page 120) argue that "... the basic principle of the ABC system is to identify activities of an organization and calculate the cost of each activity and then the cost of the product based on the consumption of activities."

The main elements of an ABC system are illustrated in Figure 15. These main elements are *resources*, *primary cost drivers*, *activities*, *activity cost pool*, *secondary cost drivers* and *the cost object* (Gerdin, 1995). These elements will be further explained in the following paragraphs.

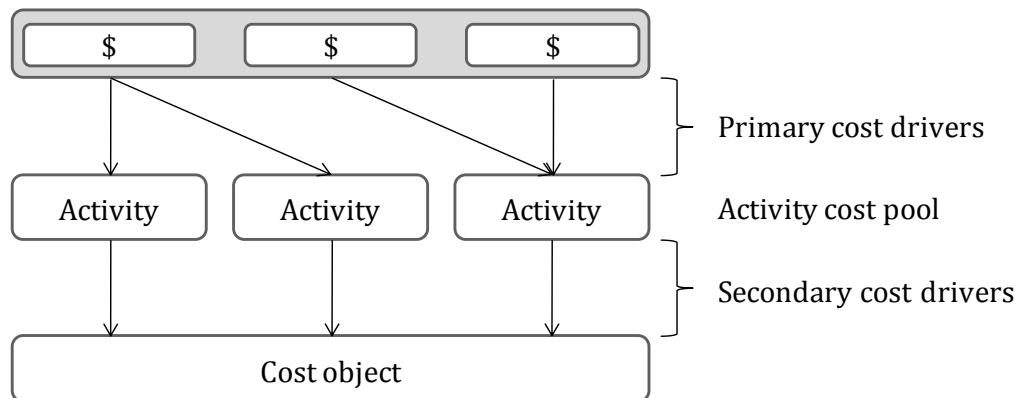


Figure 15. The design of the ABC system (Gerdin, 1995)

*Resources* are production factors, for example work, technology and material. These are necessary to perform activities. Resources are quantified in money and arise when costs are generated. (Gerdin, 1995)

*Primary cost drivers* are the links between the system's resources and the activities (Gunasekaran, 1999a). The selected primary cost drivers determine the amount of costs allocated to each activity (Gunasekaran et al., 1999b). Gunasekaran et al. (1999b) exemplify this by stating that for an activity using inspection hours as a primary cost driver the inspection related costs will be traced proportionally to the hours used by various activities.

When designing an ABC system the identification of the activities is the basic step (Gunasekaran, 1999a). *Activities* are actions or processes performed by humans or machines and when they take place, resources are transformed. When considering activities in a calculation scheme they have to be presented on a suitable aggregation level somewhere between tasks and functions, where they are still homogenous and generate the same type of output. There are two factors that have to be considered when determining the aggregation level; the cost of measuring and the effect on the calculation scheme. (Gerdin, 1995)

*The activity cost pool* is according to Gunasekaran (1999a, page 122) "... *the total cost associated with an activity*". Gunasekaran (1999a) states that each primary cost driver that is traced to an activity becomes a cost element in an activity cost pool.

*Secondary cost drivers* are measures of the frequency of the demands placed on activities by the cost object (Gunasekaran, 1999a). The purpose of these cost drivers is therefore to indicate the cost object's consummation of company resources (Gerdin, 1995).

*Cost objects* can for example be customers, products and services for which a separate cost measurement is in need of being calculated. (Gunasekaran, 1999a).

### 3.8.2 ADVANTAGES AND DISADVANTAGES OF AN ABC SYSTEM

According to Gerdin (1995), the main advantage with an ABC system is that it generates a better approximation of the products' usage of resources compared to the traditional allocation costing method. Gunasekaran et al. (1999b) add that another advantage with the ABC system is that it allocates overhead costs based on the actual consumption of the resources by each activity. Gerdin (1995) further states that disadvantages of an ABC system should not be overlooked even though it generally generates a more accurate result than other methods.

One important prerequisite, and thereby a limitation within ABC, is that it claims that the whole organization can be divided into activities. The effect is that activities within a project oriented company are not adaptable to the ABC theory since the activities are not performed uniformly over time. Another disadvantage is that ABC calculations are exclusively based on historical data which makes it difficult to come up with decisions concerning the future. (Gerdin, 1995)

Gerdin (1995) also emphasizes the effect of the cost focus that ABC, but also the traditional allocation costing method, generates. The disadvantage of the cost focus is that the relationship between cost and revenue is not discussed. There is also a risk that the cost focus leads to elimination of high cost activities at the same time as potential revenue eliminates. Another risk is that the company prioritizes the products that are profitable according to the ABC system instead of being responsive to what customers actually demand. (Gerdin, 1995)

## 4 TASK SPECIFICATION

*In this chapter the purpose of the study is further specified. The specification begins by breaking down the purpose and introducing the relevant subsystems and activities which are included in the studied system. Thereafter, a transportation purchasing process modified for ASSAB Singapore is declared. In this section the relevant purchasing steps are identified and relevant data that are to be collected are presented. The specification results in research questions which will be analyzed in later chapters in order to fulfill the purpose.*

### 4.1 SPECIFICATION OF THE PURPOSE

In accordance with Section 1.2 the purpose of the study is to “... map ASSAB Singapore’s current distribution structure and its total transportation cost.” In order to map the current distribution structure information concerning the company’s active customers and the characteristics of the current deliveries has to be gathered. Furthermore, data concerning the company’s different costs has to be collected in order to identify the costs generated by transports between ASSAB Singapore’s distribution center and the company’s Singaporean customers.

The second and last sentence of the purpose states that “Through a Request for Quotation the current situation will be compared to retrieved quotes from forwarding agents.” This indicates that a major part of the study will concern the construction of a Request for Quotation (RFQ). An RFQ will be used in this study since it is a step in a structured purchasing process. At last, to enable transportation recommendations to ASSAB Singapore, the quotes given by the forwarding agents will be analyzed and compared to the current situation.

### 4.2 SPECIFICATION OF THE STUDIED SYSTEM

As mentioned in Section 1.3, it is important to set boundaries in order to perform a focused study. Therefore the subsystems and activities involved in the earlier mentioned part of the company’s transportation structure (see Section 2.2.3), are focused in this study. In accordance with the background of the study, the study is limited to the transport between ASSAB Singapore’s distribution center to its end customers, which only makes up the last part of the supply chain, see Figure 16.

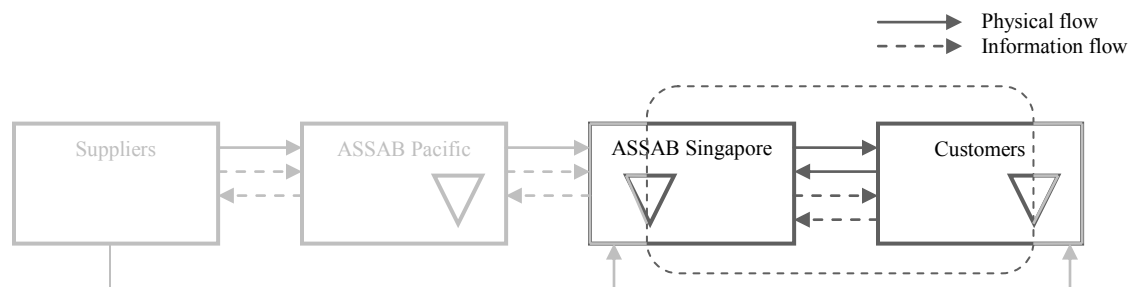


Figure 16. The focused part of ASSAB Singapore’s supply chain

Through a deeper presentation of the subsystems involved in the whole chain of activities, the studied system will be determined in the following sections. The studied system will only include subsystems and activities relevant in order to fulfill the purpose of the study.

#### 4.2.1 INVOLVED SUBSYSTEMS AND ACTIVITIES

As presented in Section 2.2.3, the chain of activities within ASSAB Singapore from order processing to invoicing involve six different subsystems; *Sales indoor*, *Accounting and Administration*, *Cutting*, *Machining*, *Heat treatment* and *Delivery*. The subsystems Cutting, Machining and Heat treatment are here defined as parts of the production process and thereby viewed upon as separate from the transportation process. Therefore, activities within these subsystems have been excluded from the study. The subsystems Sales indoor, Accounting and Administration as well as Delivery, on the other hand, are viewed upon as internal parts of the transportation process why they should be further investigated and presumably included in the studied system. Each of these three subsystems includes several activities which are presented in Figure 17 below.

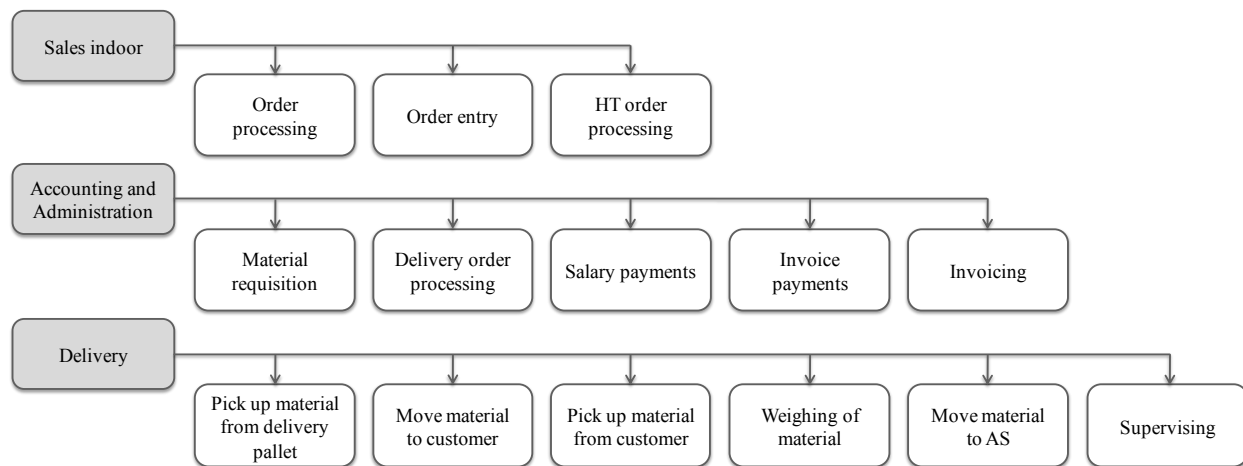


Figure 17. Relevant subsystems and their underlying activities (HT = Heat Treatment, AS = ASSAB Singapore) (modified Wee Kuong, 2010)

##### 4.2.1.1 SALES INDOOR

The subsystem Sales indoor includes the main activities *order processing*, *order entry* and *heat treatment order processing*. Order processing involves administrative work such as receiving orders from customers, stock checking, raising stock requisition and preparing cutting instructions. Order entry includes transferring order information to SAP as well as printing cutting instructions and machining job sheet. Heat treatment order processing involves compilation of heat treatment orders from customers.

Order processing, order entry and heat treatment order processing are in the beginning of the chain of activities. These activities initiate the selling process for ASSAB Singapore and are seen as part of the ordering process. They are not of further interest for this study since its focus is the actual transportation part of the company's processes. It has therefore been decided to set the boundaries of the focused process after these three activities and they have thus been delimited from the study.

In conclusion, the whole subsystem Sales indoor, with its three main activities, has been delimited from the study and will therefore not be a part of the studied system.

##### 4.2.1.2 ACCOUNTING AND ADMINISTRATION

Accounting and Administration handles activities such as *material requisition*, *delivery order processing*, *salary payments*, *invoice payments* and *invoicing*. Material requisition involves raising purchasing orders

and receiving material to put into stock. In turn, delivery order processing involves stock allocation and printing of delivery orders which are later handed over to the drivers. The activities salary and invoice payments involves accounting as well as the actual payment of salaries and supplier's invoices respectively, while invoicing includes activities from closing an order to printing customer invoices.

Material requisition is an activity independent of the transportation of steel and heat treatment products, and only a side track in the chain of activities. It has therefore been delimited from the study. Delivery order processing which involves printing of delivery orders has also been delimited since this activity will not be affected by a change in the distribution structure. Concerning the salary and invoice payments, these are both activities supporting the transportation process. Salary and invoice payments are therefore identified as relevant overhead activities and will be further analyzed in the study. The invoicing of customer invoices is, on the other hand, an activity taking place after the physical material transport. Since invoicing is seen as neither a direct step in the transportation process nor an overhead activity supporting the process, it has been decided to delimit this activity.

In conclusion, two of Accounting and Administration's activities, salary payments and invoice payments, will be included in the studied system, whereas delivery order processing, material requisition and invoicing are delimited from the study.

#### 4.2.1.3 DELIVERY

Delivery includes *picking up material from delivery pallets at ASSAB Singapore and at customers, the deliveries back and forth between ASSAB Singapore and its customers, weighing the material* as well as *supervising*. These activities, excluding weighing the material and supervising, are the direct activities in the transportation process. They make up the physical flow of steel and heat treatment products, the focus of this study. The weighing of material is not a part of the transportation flow since it does not involve moving the material between ASSAB Singapore and customers. Supervising on the other hand, must be taken into consideration since this activity is seen as an overhead activity concerning the delivery subsystem. The supervisors for steel and heat treatment drivers spend time every day on coordinating the drivers work. Therefore, supervising must be a part of the studied system.

In conclusion the subsystem Delivery's activities, picking up material from delivery pallets at ASSAB Singapore and from customers, the deliveries back and forth between ASSAB Singapore and its customers as well as supervising, are focused in this study and are therefore a part of the studied system. The activity of weighing the material has, as the only delivery activity, been delimited and will therefore not be further analyzed.

#### 4.2.2 THE STUDIED SYSTEM

With the clarification of important subsystems and their activities as a base, as well as the directives and limitations already stated in Section 1.3, the boundaries for the studied system has been drawn and is illustrated in Figure 18 below.

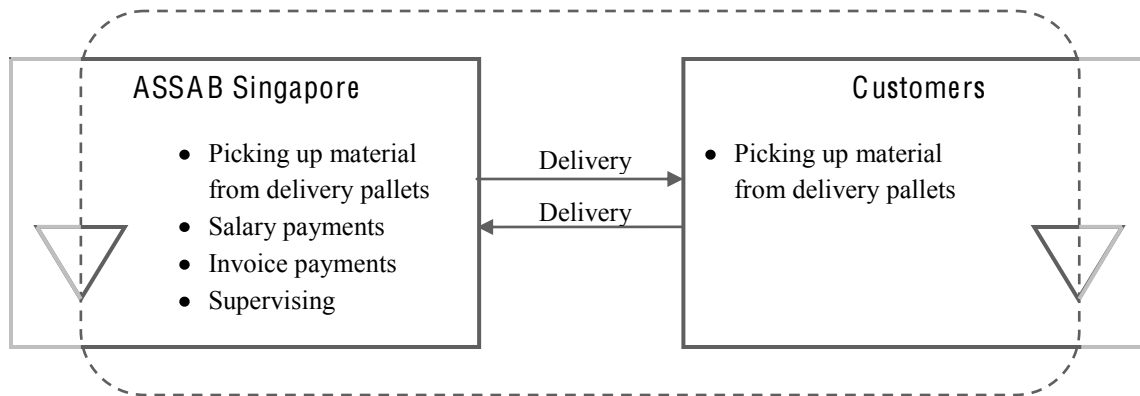


Figure 18. The studied system

Within the studied system, two administrative activities of the *Accounting and Administration* subsystem are included: *salary payments* and *invoice payments*. The two arrows within the studied system illustrate the physical material flow of the *Delivery* subsystem, the *deliveries back and forth between ASSAB Singapore and its customers*. The studied system also includes an activity within ASSAB Singapore's distribution center as well as one in the customers' warehouses. These activities are *picking up material from delivery pallets at ASSAB Singapore* and *picking up material from delivery pallets at customers*. At last, *supervising* of ASSAB Singapore's drivers is included in the studied system.

In conclusion, the above mentioned activities of the Accounting and Administration as well as the Delivery subsystem make up the studied system and will be in focus throughout the execution of the study.

### 4.3 TRANSPORT PURCHASING PROCESS FOR ASSAB SINGAPORE

In Section 3.7, Pewe et al.'s (2002) transport purchasing process and Andersson's (2007) service purchasing process were presented. Since the study involves transports, Pewe et al.'s (2002) model for transport purchasing process is believed to be the most suitable for this study. Therefore, the study's execution will be based on Pewe et al.'s (2002) model, while Andersson's (2007) theories only will be used as a complement.

According to directives given from ASSAB Pacific, see Section 1.3.1, this study will only include the three steps *Description of the current situation*, *Request for Quotation* and *Evaluation of forwarders' quotes* in Pewe et al.'s (2002) model. Therefore the steps *Negotiation and contracting* as well as *Evaluation of the cooperation* will not be included in this study.

In this study the description of the current situation has been divided into two parts, the *Total transportation cost* and the *Distribution structure*. These parts are analyzed separately leading to the following four sections covering the study's transport purchasing process for ASSAB Singapore: *Description of the current situation: Total transportation cost*, *Description of the current situation: Distribution structure*, *Request for Quotation* and *Evaluation of forwarders' quotes*, see Figure 19. An analysis will be performed in order to clarify what information is needed to be collected and what questions have to be answered, to be able to fulfill the purpose.

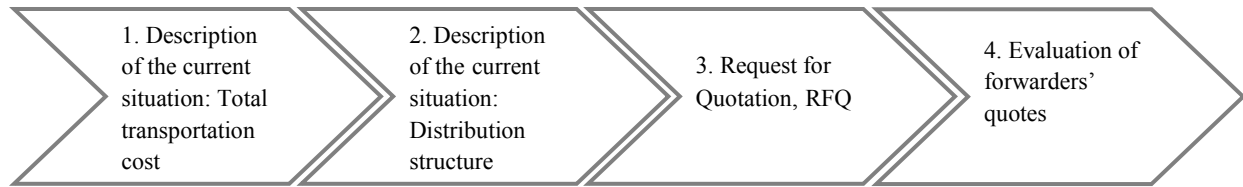


Figure 19. ASSAB Singapore's transport purchasing process (modified Pewe et al., 2002)

#### 4.4 DESCRIPTION OF THE CURRENT SITUATION: TOTAL TRANSPORTATION COST

In Section 3.7.1, it is stated that Pewe et al. (2002) perceive the description of the current situation as the most important and time consuming part of the transport purchasing process. A major part in the description of ASSAB Singapore's current situation is the calculation of the total transportation cost which is further elaborated in this section. The total cost should later be used during the evaluation phase in the purchasing process where the forwarding agents' quotes are compared with the cost of the current situation.

As presented in Section 3.1 there are three different perspectives on transportation, *the transport supplier's perspective*, *the transport buyer's perspective* and *the transport infrastructure perspective*, where the infrastructure is a prerequisite for the transport (Oskarsson et al., 2006). In the case of this study, the infrastructure is permanent and the transportation modes that will be compared use the same part of this infrastructure, i.e. the roads in Singapore. Since the infrastructure will not affect the outcome of the study the transport infrastructure perspective will not be discussed further. For this study the transport supplier's perspective has been chosen. The reason for this choice is declared in the following section.

##### 4.4.1 TOTAL COST FROM A TRANSPORT SUPPLIER'S PERSPECTIVE

In this study the *transport supplier's perspective* has been chosen for the analysis of total transportation cost for the current transport system at ASSAB Singapore. This decision is based on two reasons.

First of all, in order to perform a fair comparison between the current situation and the case with forwarding agents for designated orders, one has to compare the two alternatives with the same prerequisites. This means that one has to compare totals of the same cost elements in order to achieve a correct result. The forwarding agents calculate their costs from a transport supplier's perspective and thereafter set their price levels. Hence, the current situation should be determined in the same way, i.e. out of the same perspective. If not, the final comparison can be misleading and thereby lead to bad decisions. Secondly, when analyzing the studied system illustrated in Section 4.2.2, it is clear that several cost elements included in the total cost from a transport buyer's perspective, presented in Section 3.2, are not relevant for this study. Since ASSAB Singapore's distribution center and its operations are delimited from the study, inventory carrying cost, warehousing cost and other costs are not relevant for the study. Transportation cost and administrative cost, on the other hand, are important for the study and a part of the studied system. This further emphasizes the transport supplier's perspective, since these cost elements are exclusively included in its total transportation cost model, whereas the transport buyer's perspective is more extensive.



When using the transport supplier's perspective the transportation cost can be broken down into *fixed*, *variable* and *overhead costs*, see Section 3.2 (Pewe et al., 2002). These three cost groups' importance to the study will be elaborated further in the following sections.

#### 4.4.2 FIXED TRANSPORTATION COSTS

Fixed transportation costs comprise vehicle depreciation, driver's license, vehicle insurance and drivers' costs, see Section 3.2.1 (Rushton et al., 2006). Pewe et al. (2002) claim that, besides the vehicle depreciation, vehicle insurance and the drivers' cost, other fixed costs such as garage cost, fixed vehicle tax and interest has to be considered. In the following discussions below, the current fixed transportation cost will be analyzed further in order to find out which elements are crucial to ASSAB Singapore's situation.

As mentioned in Section 2.2.2 and Section 2.2.3, ASSAB Singapore owns two trucks and three vans. Out of these five vehicles one truck is a spare and therefore is considered as an overhead cost. In order to determine ASSAB Singapore's vehicle depreciation cost, one must first determine whether the vehicles already are depreciated or not. If the vehicles already are depreciated, no further investigation has to be performed. On the other hand, if the vehicles are not depreciated one has to look into this further since this cost element will be included in the fixed transportation cost. Hence, to find out ASSAB Singapore's total vehicle depreciation cost per year, the following research questions must be answered:

- *Are ASSAB Singapore's vehicles fully depreciated?*
- *How big is ASSAB Singapore's vehicle depreciation per year?*

In Singapore, it is compulsory to pay vehicle insurance to be allowed to drive on the roads. Therefore, the company's vehicles that are used for the transports between ASSAB Singapore and its end customers generate insurance costs. The insurance cost for the vehicles will be included in the fixed transportation cost, why the following research question must be analyzed further:

- *How much does ASSAB Singapore pay for vehicle insurance annually?*

Throughout a year, ASSAB Singapore's own drivers generate different types of fixed costs. Besides the salaries, the drivers also cause costs in terms of pension, holiday pays and insurance. Another fixed cost that in some cases arises is the cost of driver's license. These costs must be taken into consideration when determining the total fixed cost for transportation. Hence, the following research questions must be analyzed further:

- *What is the total cost for the drivers per year considering salaries, pensions, holiday pays and insurances?*
- *Does ASSAB Singapore pay for the drivers' licenses?*
- *How much does ASSAB Singapore pay for the drivers' licenses annually?*

When the drivers have finished their daily routes, the vehicles must be parked somewhere. Therefore, it is essential to find out where ASSAB Singapore's drivers park the company vehicles. If the vehicles are parked in a garage or on an external parking lot, these costs must be included in the fixed cost of ASSAB Singapore's transports. The following research questions must be investigated in order to clarify whether the garage cost or the cost for an external parking lot will be included or not.

- *Does ASSAB Singapore have a garage or external parking lots for the vehicles?*
- *What is the total cost for the garage or external parking lots per year?*

Furthermore, when determining the total fixed transportation cost, one also has to consider additional costs that the vehicles are causing. In this study the additional cost that has to be considered is fixed vehicle tax. Hence, the following research question must be analyzed further:

- *How much does ASSAB Singapore pay in fixed vehicle tax?*

In Section 2.2.2, it is stated that ASSAB Singapore has subcontracted a vehicle beyond the trucks and the vans that they own. As for ASSAB Singapore's own vehicles, the subcontracted vehicle comprises fixed costs. Hence, the following research question must be elaborated further:

- *How much does ASSAB Singapore pay for the subcontracted vehicle per year?*

#### 4.4.3 VARIABLE TRANSPORTATION COSTS

As stated by Rushton et al. (2006), variable transportation costs includes fuel, repairs and maintenance, lubricants, tire wear and drivers' overtime, see Section 3.2.2. Besides the variable costs presented by Rushton et al. (2006), Pewe et al. (2002) emphasize that the running vehicle tax, which depends on the distance covered by the vehicle, must be taken into consideration.

As stated by Rushton et al. (2006) in Section 3.2.2, the cost of fuel is normally a significant portion of the running cost as a result of the high fuel consumption of commercial vehicles and the periodic shortages and heavy taxation. Therefore, the cost of fuel must be taken into consideration. Consequently, the following research question must be investigated:

- *What is the total fuel cost per year?*

The need of repairs and maintenance of a vehicle will vary depending on how much the vehicle has been used. A vehicle that travel long distances every year needs more service than a vehicle that travels shorter distances, see Section 3.2.2. It is therefore crucial in ASSAB Singapore's case to find out the yearly cost for repairs and maintenance for the company's own vehicles. The reasoning leads to the following research question:

- *How much does ASSAB Singapore pay for repairs and maintenance of the vehicles annually?*

Sometimes it is necessary for ASSAB Singapore's drivers to work overtime, see Section 2.2.3. The end of the day depends on that particular day's demand. Therefore, in ASSAB Singapore's case, it must first be determined whether the drivers are compensated for overtime or not. If they are, the cost for drivers' overtime must be calculated. The following research questions will answer this inquiry:

- *Does ASSAB Singapore compensate their drivers when working overtime?*
- *How much does ASSAB Singapore pay for drivers' overtime annually?*

There can also exist smaller cost items within the studied system that should not be overlooked. These costs might together make up a considerable cost item for the company, why they have to be considered. In ASSAB Singapore's case the cost items that have to be investigated are costs for lubricants, tire wear as well as running vehicle tax. Hence, the following research questions must be answered:

- *What is the annual cost for lubricants used by the vehicles?*
- *What is the total cost for tire wear per year?*
- *How much does ASSAB Singapore pay in running vehicle tax per year?*

#### 4.4.4 OVERHEAD TRANSPORTATION COSTS

Overhead transportation costs are, according to Rushton et al. (2006), classified as indirect costs since they do not relate directly to a specific vehicle, see Section 3.2.3. Instead they should be borne by the whole fleet of vehicles (Rushton et al., 2006). According to Rushton et al. (2006), *Fleet overhead costs* consist of back-up equipment and personnel required to run a fleet of vehicles. *Business overhead cost* can be divided into transport departments and company administrative overheads (Rushton et al., 2006).

ASSAB Singapore's fleet overhead cost is made up by two parts, the cost of the company owned back-up truck and their back-up driver, see Section 2.2.3. In order to determine the costs for these two back-up resources the following research questions must be posed:

- *What is the annual cost of the back-up equipment generated by the studied system?*
- *What is the annual cost of the back-up personnel generated by the studied system?*

Business overhead costs, in ASSAB Singapore's case, only consist of administrative overheads since the company does not have a transport department. The transport administration is mainly handled by the Accounting and Administration department and the routes are planned by the drivers. Relevant activities in terms of administrative overheads for this study are, as stated in Section 4.2.2, salary payments and invoice payments. In order to determine the cost of ASSAB Singapore's administrative overheads, the following research questions must be analyzed:

- *What is the total administrative cost per year considering processing of salary payments?*
- *What is the total administrative cost per year considering processing of invoice payments?*

Besides the direct cost for the administrative work additional administrative costs, including *costs of supervising, buildings* and *bank charges*, must be taken into consideration (Rushton et al., 2007). Since ASSAB Singapore makes all payments with checks they do not have any bank charges to pay. This means that no research question about bank charges has been developed.

To determine the total administrative overheads the following research questions must be investigated:

- *What is the total annual cost of supervising concerning the studied system?*
- *What is the total annual cost of buildings concerning the studied system?*

#### 4.4.5 TOTAL TRANSPORTATION COST MODEL

After the identification of all individual transportation cost elements the total transportation cost has to be calculated. Figure 20 illustrates the *total transportation cost model* that will be used to calculate ASSAB Singapore's total transportation cost. As illustrated, the model includes several elements of fixed, variable and overhead costs. From now on, this model is referred when discussing the total transportation cost.

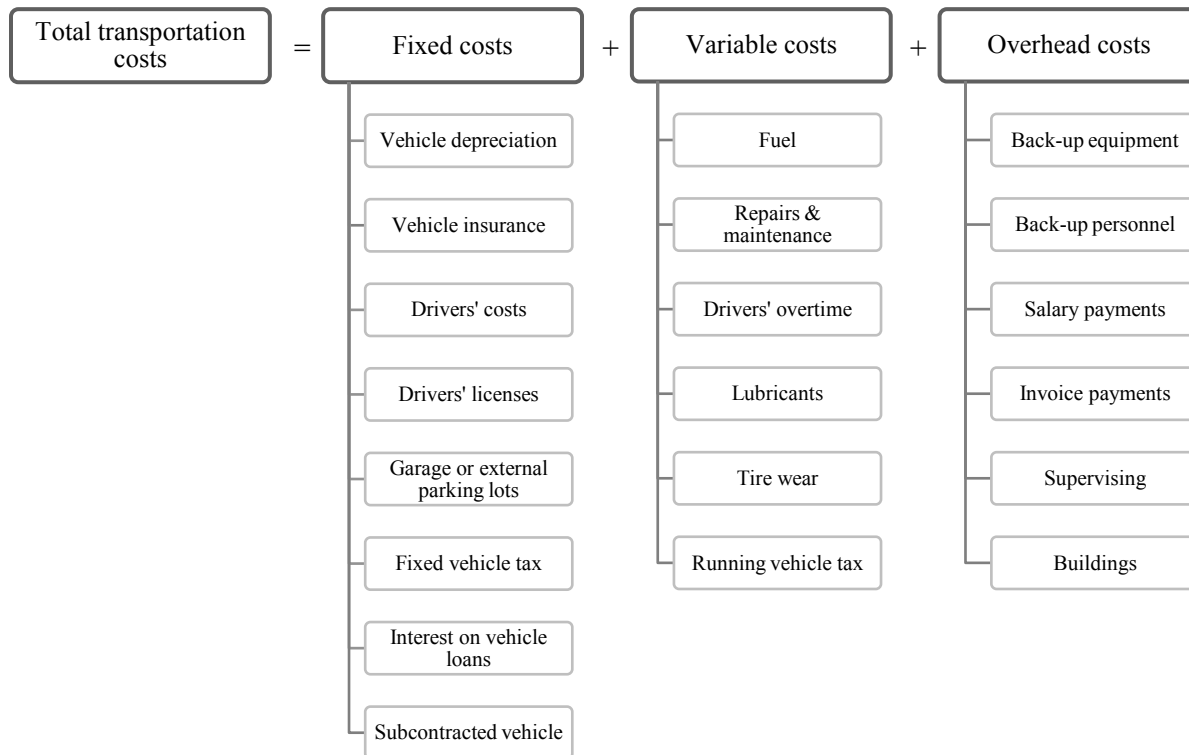


Figure 20. Total transportation cost model for ASSAB Singapore (modified Pewe et al. 2002; Rushton et al., 2007)

#### 4.5 DESCRIPTION OF THE CURRENT SITUATION: DISTRIBUTION STRUCTURE

The second part of the description of the current situation is the specification of the current distribution structure. The data retrieved from this analysis will be used when constructing the RFQ and thereby be a basis for the following steps of the transport purchasing process as discussed in Section 3.7.1. Identifying ASSAB Singapore's current distribution structure is therefore crucial for achieving a thorough performed analysis of the possible gains of contracting a forwarding agent for designated orders.

In Section 3.7.1 it is stated that the current situation should include the real delivery structure of the company's different flows throughout a year. Further it is essential that all concerned suppliers, customers and products are represented in this delivery structure. Since this particular study is focusing on the transportation between the company and its customers, these two will be covered in the delivery structure whereas the suppliers will be delimited.

Pewe et al. (2002) state that the current situation should both indicate the totality as well as specific details, see Section 3.7.1. It should cover the areas of:

- A preliminary purchasing plan
- How the goods are sold on different markets
- Current delivery conditions
- How the goods are packed and handled
- Lead time demand
- Customers' localization
- Individual purchase frequency

- Customers' distribution of weights purchased
- Density of goods
- Shipments and their individual costs
- The total declaration of shipments and total costs

These areas are further elaborated below in accordance with the study's purpose and ASSAB Singapore's current situation.

A preliminary purchasing plan is not of interest for this study since the material supply is delimited in the studied system, see Section 4.2.2. It will therefore not be mapped nor analyzed in this study.

How the goods are sold on different markets, current delivery conditions and how the goods are packed and handled are already presented in the presentation of ASSAB Singapore, Section 2.2.1, and in the current situation see Sections 2.2.2 and Section 2.2.3. No further data will therefore be collected for these areas.

Today ASSAB Singapore's customers are not complaining about the company's delivery lead time and the survey, mentioned in Section 2.2.1, indicate that the customers are satisfied. Since the company focuses on offering their customers high service when it comes to lead time this is not an element that they are prepared to impair. As stated in Section 2.2.4 the current delivery lead time varies between one to two days but no data about the actual time in number of hours can be retrieved. Due to no complaints and the fact that no actual data exists the lead time demand can only be assumed to be between one and two days. No further analysis of the current lead time demand will be performed.

The customers' localization is a major factor when planning transportation routes. Their localizations are therefore important to establish and thereafter present to a potential forwarding agent. Due to time constraints and that the routes today are divided into different geographical regions covering the customers' locations, see Section 2.2.2, the localization of customers will be delimited to the number of customers within a particular geographical region. Individual purchase frequency is also important information to present to a potential forwarding agent. It will therefore be investigated how much and frequently the different customers order within a specific region.

In accordance to this reasoning customer's localization and their purchase frequency have to be investigated. Inquiry should clarify facts about ASSAB Singapore's customers within the three different geographical regions. It is essential to understand how large both in terms of number of customers, number of deliveries and sales, the different regions are. Hence, the following research questions must be further investigated:

- *How many customers does ASSAB Singapore supply in the different regions?*
- *How frequently does ASSAB Singapore deliver goods to customers within a region?*
- *How big is the sales value within a region?*

The customers' distribution of weights purchased correlates to the density of goods. The customers' distribution of weights purchased affects the distribution through the frequency of different weights of delivery orders. Density of goods is a vital area since weight and volume of the products are the most important material properties when considering transportation of tool steel. Steel is a highly dense material and can therefore cause problems concerning maximum load of a truck. Further, ASSAB

Singapore sells both small and large pieces of steel to customers, something that complicates the loading and optimization of the trucks. In order for the potential forwarding agents to place a quote to ASSAB Singapore, they need information about the products that they are supposed to transport. To get a proper overview of the material that has to be transported the following questions will be elaborated:

- *How big is the sales volume within a region?*
- *What is the maximum and minimum delivery weight?*
- *What is the average and median delivery weight?*
- *What is the maximum length of products sold?*
- *What is the average length of products sold?*

One of the future steps of this study is a comparison of forwarding agents' quotes to the current situation. *Separate shipments and their individual costs* as well as *the total declaration of shipments and total costs* are therefore essential to establish and calculate respectively. In Section 1.3, it is stated that the study involves constraints in terms of time. Therefore, it has been decided to only perform the total declaration of shipments and total costs. A second reason, besides the time constraint, why this perspective has been chosen is because there are no costs determined on order or delivery level within ASSAB Singapore today. Therefore, only data covering the total declaration of shipments will be collected during the description of the current situation. However, research questions concerning this area have already been stated in Section 4.4.1.

#### 4.6 REQUEST FOR QUOTATION

As described in Section 3.7.2 an RFQ should be constructed for several reasons. In summary these reasons are; to define the scope of the study for everyone involved, to maintain an unbiased information flow out to all forwarding agents, to establish total confidentiality rules, to facilitate an objective comparison of incoming quotes as well as to enable selecting a supplier in a structured and standardized way. The main question hereby, is not why the RFQ should be constructed but what it should include. It is therefore important to identify what data, stated in Section 3.7.2, that is suitable for this study as well as how it should be presented in an RFQ. This will be an important part of the study since the forwarding agents' quotes will be given according to its content and structure. As stated in Section 3.7.2, Pewe et al. (2002) declare different important parts that should be present in an RFQ. These are *introduction, goods and product description, transport system, delivery statistics and structure, prices and terms, administrative routines and other*.

In the case of ASSAB Singapore, the introduction should include a short presentation of the company and the distribution structure for steel and heat treatment goods. This information has already been collected and is stated in Chapter 2.

After the introduction, a concise description of the steel and the products that are delivered back and forth for heat treatment should follow. The product information will be retrieved from Chapter 2. But still there is some information about the properties of the steel that has to be further investigated. An example of this is that potential elements affecting the steel during transports have to be identified. Important to underline in the description is also how the value added activities that the customers have brought to the steel, before returning it to ASSAB Singapore for heat treatment, affects the transports. To investigate these potential effects the following research question will be investigated:

- *Are there any special considerations to be taken into account when transporting heat treatment and steel products?*

In the sections of transportation system and delivery statistics and structure, relevant parts of the mapping and calculations of the description of the current situation will be summarized in an explanatory matter. The information will thereby include geographical coverage, load and delivery frequency. This data will be given to enable the potential forwarding agents to place realistic and quantitative quotes. An important figure in this section will be the determined weight limit for the designated orders that are to be outsourced. Determining this weight limit will only be possible after the quantitative data has been analyzed and a further discussion has been held with the management of ASSAB Pacific.

- *What will be the weight limit for designated orders?*

Concerning prices and terms in the RFQ, ASSAB Pacific will have to state during what period of time the potential contract should run. Hence, the following research question must be answered:

- *For how long period of time should the contract run?*

Concerning prices, the RFQ will declare to the forwarders that a base price has to be stated and that they should attach a *key* that provides the price limits for adjustments of, for example, fuel and number of designated orders, see Section 3.7.2. For this section no research questions have to be posed.

Considering administrative routines and other information there are no explanatory parts in this RFQ that has to be included as these will be a part of future purchasing steps. Therefore no research questions concerning these areas will be investigated.

Besides the parts of an RFQ that Pewe et al. (2002) find important, Rushton et al. (2007) argue that a part concerning *distribution service levels* should be included, see Appendix V. This part should according to Rushton (2007) be included in the RFQ to enable a qualitative evaluation of forwarding agents' quotes, complementing the quantitative evaluation. As stated in Section 3.6 Coyle et al. (2006) argue that reliability in transit time, i.e. *delivery reliability*, is the most important delivery service element to evaluate when choosing a carrier. Also Pewe et al. (2002) identify delivery reliability as an important factor, see Section 3.7. ASSAB Singapore's demand of delivery reliability towards a future forwarding agent should therefore be determined and stated in the RFQ. Hence, the following research question must be answered:

- *What demand of delivery reliability does ASSAB Singapore require from a forwarding agent?*

Other important delivery service elements to take into consideration when choosing a carrier are, according to Coyle et al. (2006), *delivery lead time* and *flexibility* whereas Pewe et al. (2002) argue for *delivery dependability* and *flexibility*. Delivery lead time and delivery dependability can be quantified, whereas flexibility is only a subjective assessment. It has therefore been decided to exclude the service element flexibility from this RFQ. Further, the delivery dependability will also be excluded from the RFQ since the forwarding agent cannot be responsible for the quantity and quality of the goods delivered to the customers. It is ASSAB Singapore's responsibility to make sure that the delivery dependability reaches a satisfying level. In accordance to Pewe et al.'s (2002) and Coyle et al.'s (2006) theories concerning important factors when choosing a carrier, the following research question has been developed:

- *What delivery lead time demand does ASSAB Singapore require from a forwarding agent?*

In the RFQ the demanded delivery reliability and delivery lead time will to be stated as criteria that have to be fulfilled. The research questions regarding these delivery service elements are the last questions that need to be investigated for the actual construction of the RFQ.

Another important part of the RFQ process, besides the actual construction, is the selection of RFQ receivers, i.e. forwarding agents. When making the selection of forwarding agents for the RFQ process, selecting criteria must be identified. Criteria that Pewe et al. (2002) find important to take into consideration when purchasing transport services are:

- Reliability
- Capacity of flexibility
- Cost efficiency
- Transport system knowledge
- Security transport system
- Geographical coverage
- Environmental considerations
- IT awareness
- Financial stability
- Tracking systems
- Deviation reports
- Quality in operations

Dickson's (1966) and Weber et al.'s (1991) theories regarding selection criteria, see Section 3.7.2, are also presented in the report, but their theories are foremost focused on product purchasing. Since this study concerns transport purchasing Pewe et al.'s (2002) criteria are considered to be the most accommodated and will therefore be used exclusively.

Reliability and capacity of flexibility are both service elements. Reliability will, as already explained, be a part of the written RFQ whereas the flexibility has already been delimited. Concerning the cost efficiency, it is the factor that will be declared in the RFQ quotes and can therefore not be taken into account when making a first selection of RFQ receivers.

Since the RFQ only will be sent out to active forwarding agents the transport system knowledge is considered as a prerequisite and nothing that has to be further investigated. As for the security transport system none is needed for ASSAB Singapore's deliveries and will therefore neither be investigated.

Quality in operations and deviation reports have been interpreted as historical performance, a criterion that from now on will be used for Pewe et al.'s (2002) two criteria. Concerning the historical performance, geographical coverage, environmental considerations, IT awareness, financial stability and tracking systems they are all criteria that are applicable on the case of transport purchase for ASSAB Singapore. How important they are in comparison to each other has to be further investigated. In order to investigate this, the following research question must be elaborated:

- *Which are the most important criteria for ASSAB Singapore when selecting forwarding agents for the RFQ process?*



When the most important criteria for ASSAB Singapore have been identified a research has to be performed concerning which forwarding agents actually live up to these criteria. Hence, the following research question will be investigated:

- *Which forwarding agents live up to the criteria set by ASSAB Pacific?*

Concerning the question of how many forwarders a buyer should send his RFQ to, no straight answers can be found. Authors argue for two to eight forwarders, see Section 3.7.2. In this study the RFQ will be sent out to three forwarders, partially because it is recommended by Pewe et al. (2002) but also due to time constraints and because this number of quotes is a reasonable number to compare. After deciding the number of forwarders to send the RFQ to and evaluating how the different forwarders live up to the criteria it is essential to decide which forwarders to send the RFQ to. Hence, the following research questions must be answered:

- *To which forwarding agents will the RFQ be sent?*

#### 4.7 EVALUATION OF FORWARDERS' QUOTES

In Section 3.7.3, Andersson (2007) states that the most essential selection criteria, when evaluating and selecting a supplier for a logistics service, are *price*, *service* and *competence*. Pewe et al. (2002) agree with Andersson (2007) and claim that the evaluation will present the *financial outcome* for each quote, i.e. the total cost on annual basis compared to the current situation. The competence criterion is a very subjective criterion, meaning that it is hard to get comparative information about the different forwarding agents. This criterion has therefore been delimited and will not be elaborated further in this study. In the RFQ, requirements of the relevant delivery service elements, *delivery lead time* and *delivery reliability* are stated since it is important that the forwarding agents can live up to these criteria. These criteria are regarded as knock-out criteria why a qualitative evaluation will not be performed. This leaves the price as the sole evaluation criterion derived from the RFQ.

The first step in the evaluation of quotes will be observing and analyzing the different service providers' base prices for designated orders. Hence, the following research question must be elaborated further:

- *What are the base prices for designated orders in the forwarding agents' quotes?*

The forwarding agents have been asked in the RFQ to specify this base price when placing their quotes and to attach a key that provides the price limits for fluctuating adjustments, see Section 4.6. There is a risk that the costs of fuel or currency fluctuate during the time of contract. Since the study only involves local deliveries, i.e. all payments will be performed in SGD, no fluctuations between currencies will have to be taken into consideration. Hence, it is only important to evaluate the different service providers' adjustments for fuel.

- *What is the price addition concerning cost fluctuations in fuel?*

The forwarding agents have in the RFQ further been asked to include a key for price limits for fluctuating number of designated orders. This potential price addition presented in the quotes must therefore also be evaluated. An evaluation will be performed by answering the following question:

- *What is the price addition concerning fluctuations in number of designated orders?*

The next step after evaluating base price and price addition in individual quotes is to quantify the variation of the different quotes. The following research question must therefore be investigated:

- *What are the variations in price among the forwarding agents' quotes?*

In Section 3.7.3 Pewe et al.'s (2002) definition of *financial outcome* is declared as the total annual cost of quotes compared to the current total cost. In this study making such a comparison is also given as a directive from ASSAB Pacific. As a first step in this comparison process the following research questions have to be investigated:

- *What is the current total transportation cost for designated orders?*
- *What is the total transportation cost when complementing current transportation mode with forwarding agents?*

As the last step in the comparison process and in the evaluation of forwarders' quotes the current transportation cost has to be compared with the cost when using forwarding agents for designated orders. When all the questions above as well as the following question have been answered the purpose of this study has been accomplished.

- *What is the difference in total transportation cost between the current transportation mode and a transportation mode complemented by forwarding agents for designated orders?*

## 5 METHODOLOGY

*In this chapter the study approach is first presented. Thereafter, the methodology used when performing the field study is illustrated. The presentation of the different methods used includes formulas and step-by-step procedures. The chapter follows the same structure as the preceding to facilitate the reading.*

### 5.1 STUDY APPROACH

This study is a *case study* according to Björklund et al.'s (2003) definition, since it is focused on one deeper investigation rather than several broad investigations. The case study is both *qualitative* and *quantitative* since it is based on interviews, delivery service element demands and calculations to obtain the total transportation cost of the current situation.

In the task specification, several research questions concerning the studied system's four-step transport purchasing process, see Figure 19, were presented. To answer these research questions, *primary data* as well as *secondary data* have been collected and supplied from ASSAB Singapore. Björklund et al. (2003) define primary data as data created for the purpose of the study and, in this study the primary data has been collected through interviews at the company. Secondary data is data written or presented for another purpose than the particular study (Björklund et al., 2003). The secondary data in this study consists of literature studies as well as quantitative data retrieved from ASSAB Singapore's business management software, SAP.

### 5.2 METHODOLOGY OUTLINE

In this study the methodology, i.e. ASSAB Singapore's transport purchasing process, composes the major part of the field study. Therefore, the focus in this chapter is on the four steps; Description of the current situation: Total transportation cost, Description of the current situation: Distribution structure, Request for Quotation and Evaluation of forwarders' quotes, see Figure 21. Figure 21 also illustrates the chronological order of the steps in the transport purchasing process. This methodology structure will follow throughout this chapter to facilitate the reading.

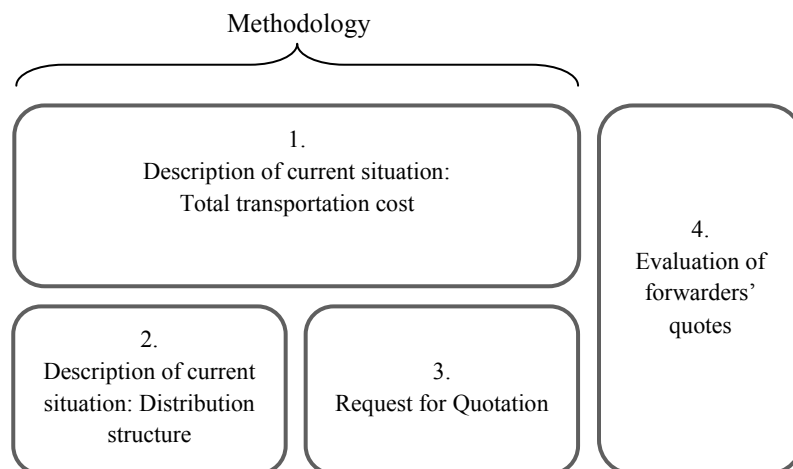
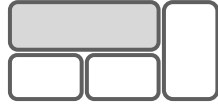


Figure 21. Methodology structure, the transport purchasing process for ASSAB Singapore (modified Pewe et al, 2002)

The total transportation cost of the current situation was determined at the same time as the current distribution structure was mapped. The information gathered from the description of the distribution

structure was later used when the RFQ was constructed. When the current transportation cost had been mapped and quotes had been received from three forwarding agents, the quotes were evaluated and compared to the current transportation cost.

### 5.3 DESCRIPTION OF THE CURRENT SITUATION: TOTAL TRANSPORTATION COST



The *Description of the current situation: Total transportation cost* is the first step in the methodology structure. In the task specification, several research questions concerning this step were developed. To answer these research questions, both primary and secondary data have been collected from ASSAB Singapore.

To map the current total transportation cost at ASSAB Singapore, the corresponding research questions in the task specification had to be answered. These questions pinpoint different cost elements that together make up the total transportation cost and the answers had to be in the form of quantitative data to enable the final cost calculation. This secondary data was gathered at ASSAB Singapore's head office from the company's business management software, SAP, in collaboration with the company's Financial Controller. The data gathered concerns January to December 2009.

#### 5.3.1 FIXED TRANSPORTATION COSTS

The following research questions concerning fixed transportation costs were developed in the task specification:

- *Are ASSAB Singapore's vehicles depreciated?*
- *How big is ASSAB Singapore's vehicle depreciation per year?*
- *How much does ASSAB Singapore pay for vehicle insurance annually?*
- *What is the total cost for the drivers per year considering salaries, pensions, holiday pays and insurances?*
- *Does ASSAB Singapore pay for the drivers' licenses?*
- *How much does ASSAB Singapore pay for the drivers' licenses annually?*
- *Does ASSAB Singapore have a garage or external parking lots for the vehicles?*
- *What is the total cost for the garage or external parking lots per year?*
- *How much does ASSAB Singapore pay in fixed vehicle tax per year?*
- *How much does ASSAB Singapore pay for the subcontracted vehicle per year?*

The research questions were posed to ASSAB Singapore's Financial Controller. Some of the questions could be answered directly, while some of them had to be retrieved from SAP. Costs concerning the vehicles were retrieved from a compiled document for January to December 2009. All questions were answered during the consultation with the Financial Controller. The results concerning the fixed transportation costs are presented in Section 6.1.1.

#### 5.3.2 VARIABLE TRANSPORTATION COSTS

In the task specification, see Section 4.4.3, the following research questions concerning ASSAB Singapore's variable transportation costs were developed:

- *What is the total fuel cost per year?*
- *How much does ASSAB Singapore pay for repairs and maintenance of the vehicles annually?*
- *Does ASSAB Singapore compensate their drivers when working overtime?*

- *How much does ASSAB Singapore pay for drivers' overtime annually?*
- *What is the annual cost for lubricants used by the vehicles?*
- *What is the total cost for tire wear per year?*
- *How much does ASSAB Singapore pay in running vehicle tax per year?*

The answers to the questions were found when consulting ASSAB Singapore's SAP data and conferring with the Financial Controller. The total fuel cost per vehicle as well as the cost concerning repairs and maintenance were found in a compiled document for January to December 2009 whereas the overtime were to be found in ASSAB Singapore's payroll. The result of all variable cost calculations are declared in Section 6.1.2.

### 5.3.3 OVERHEAD TRANSPORTATION COSTS

Concerning overhead transportation costs, the cost elements retrieved from SAP had to be further analyzed and divided to only cover the studied system. The first question concerning overhead costs was:

- *What is the annual cost of the back-up equipment generated by the studied system?*

ASSAB Singapore's back-up equipment consists of one back-up truck that only runs under certain circumstances that are explained in Section 2.2.3. The truck is mostly used for the studied activities but also for other types of transportation. Since, the truck is used for activities both included and excluded from the studied system the cost of the back-up truck had to be divided into two parts. The Operations Manager was interviewed to establish the percentage of use of the back-up truck within the studied system. Furthermore, the total cost of the back-up truck was gathered from SAP.

To calculate the annual cost of the back-up equipment generated by the studied system Activity Based Costing (ABC) was used, see Section 3.8. The different ABC elements are illustrated in Figure 22. The resource is the back-up truck and the primary cost driver is the percentage of time the truck is used for different activities. The activities are transports within system, not in use and transports outside system. The secondary cost driver is the percentage of time that the activities are performed within or outside the system. Finally the cost objects are within the studied system and outside the studied system.

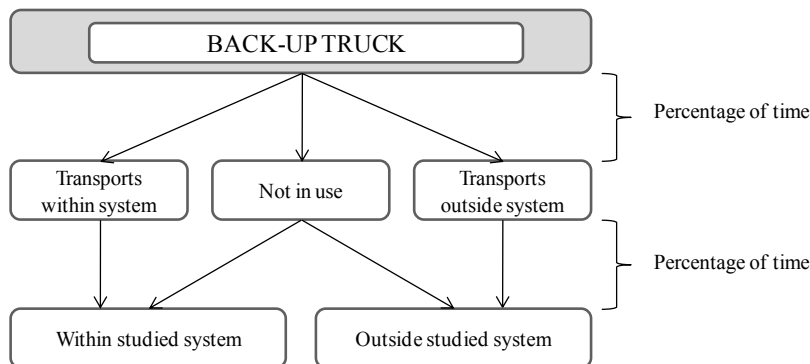


Figure 22. ABC structure for annual cost of the back-up equipment within studied system (modified Gerdin, 1995)

Formula 1 was used to calculate the annual cost of the use of back-up equipment within the studied system.

$$\begin{aligned}
 & \text{Cost}_{\text{Back-up equipment within studied system}} \\
 &= (\text{Percentage of time used on transports within system}_{\text{Back-up truck}} \\
 &\quad \times \text{Percentage of time for transports within studied system}_{\text{Back-up truck}} \\
 &\quad + \text{Percentage of time not in use}_{\text{Back-up truck}} \\
 &\quad \times \text{Percentage of time not in use within studied system}_{\text{Back-up truck}}) \\
 &\quad \times \text{Cost}_{\text{Back-up truck}}
 \end{aligned}$$

Formula 1. Cost for back-up equipment within studied system

As for cost of back-up equipment the following research question had to be answered concerning back-up personnel:

- *What is the annual cost for back-up personnel?*

The annual cost for back-up personnel retrieved from SAP was composed by the company's back-up driver. To answer the question about to what extent the back-up driver is needed within the studied system the Operations Manager at ASSAB Singapore was consulted.

To organize the total cost of back-up personnel, the ABC structure in Figure 23 was used. The resource is the back-up driver whereas the primary cost driver is the percentage of time used on different activities. There are two activities; making deliveries and other assignments. The secondary cost driver is the percentage of time that the activities are performed within or outside the system. Finally the cost objects are within studied system and outside studied system.

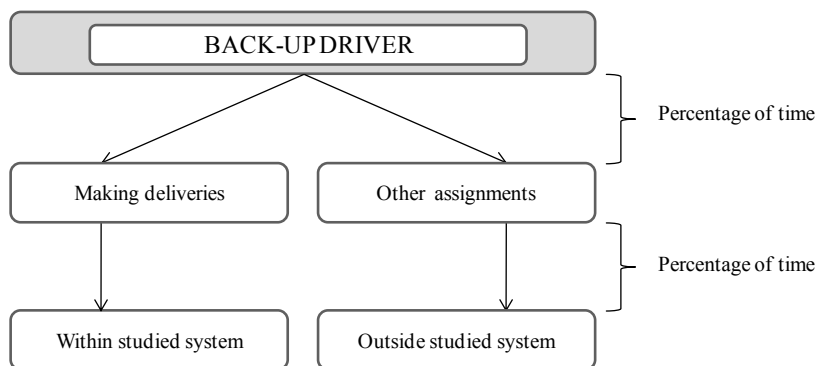


Figure 23. ABC structure for annual cost of the back-up personnel within the studied system (modified Gerdin, 1995)

For the calculations of costs for back-up personnel within studied system, Formula 2 was used.

$$\begin{aligned}
 & \text{Cost}_{\text{Back-up personnel within studied system}} \\
 &= \text{Percentage of time spent on making deliveries}_{\text{Back-up driver}} \\
 &\quad \times \text{Percentage of time making deliveries within studied system}_{\text{Back-up driver}} \\
 &\quad \times \text{Cost}_{\text{Back-up driver}}
 \end{aligned}$$

Formula 2. Cost for back-up personnel within studied system

To determine the business overhead costs, research questions concerning salary and invoice payments had to be answered. First, the question regarding salary payments was posed.

- *What is the total administrative cost per year considering processing of salary payments?*

At ASSAB Singapore the salary payments are performed by the Salary Administrator. The annual cost for the Salary Administrator was retrieved from SAP, whereas the actual time spent on salary payments was estimated by the Financial Controller.

Also for this overhead cost ABC was used. The ABC structure for the annual cost of the Salary Administrator's work within the studied system is illustrated in Figure 24. The resource is the Salary Administrator. The primary cost driver is the percentage of time used on different activities which are salary payments and other assignments. The secondary cost driver is the percentage of salaries paid and the cost objects are within studied system and outside studied system.

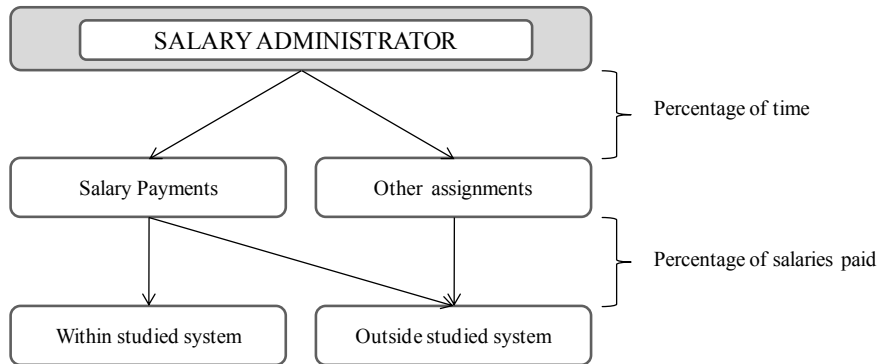


Figure 24. ABC structure for annual cost of the salary payments within studied system (modified Gerdin, 1995)

To calculate the annual cost for the salary payments within the studied system the Formula 3 was used.

$$\begin{aligned}
 &Cost_{\text{Salary payments within studied system}} \\
 &= \text{Percentage of time spent on salary payments}_{\text{Salary administrator}} \\
 &\times \frac{\text{Number of drivers}}{\text{Number of employees}} \times Cost_{\text{Salary administrator}}
 \end{aligned}$$

Formula 3. Cost for salary payments within studied system

To determine the second business overhead cost, the cost of invoice payments, the following question was posed.

- *What is the total administrative cost per year considering processing of invoice payments?*

At ASSAB Singapore the invoice payments are performed by the Accounting Clerk. The annual cost for the Accounting Clerk as well as the portion of transportation invoices out of the total number of invoices was retrieved from SAP.

The ABC structure used to answer this research question is illustrated in Figure 25. The resource is the Accounting Clerk and the primary cost driver is the percentage of time used on the activity accounting activities. The secondary cost driver is the percentage of invoices whereas the cost objects are within studied system and outside studied system.

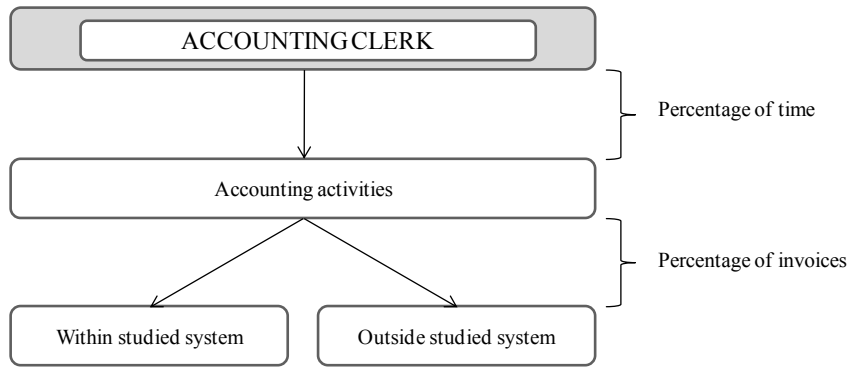


Figure 25. ABC structure for annual cost of invoice payments within studied system (modified Gerdin, 1995)

Formula 4 that was used to calculate the annual cost of invoice payments generated by the studied system is stated below.

$$\begin{aligned}
 &Cost_{Invoice\ payments\ within\ studied\ system} \\
 &= Percentage\ of\ time\ spent\ on\ accounting\ activities_{Accounting\ Clerk} \\
 &\times \frac{Number\ of\ transport\ invoices}{Total\ number\ of\ invoices} \times Cost_{Accounting\ Clerk}
 \end{aligned}$$

Formula 4. Cost for invoice payments within studied system

As mentioned in Section 4.4.4 additional overhead costs, in this case costs generated by the drivers' supervisors and buildings, must be determined. Therefore, the next research question posed was:

- *What is the total annual cost of supervising concerning the studied system?*

The annual cost of supervising was retrieved from SAP. As there are two supervisors for the drivers, one supervising the steel driver and another supervising the heat treatment drivers, the Operations Manager had to be consulted for the estimation of time spent on supervising.

The ABC structure used is illustrated in Figure 26. The resources in this structure are the two supervisors. The primary cost driver is the percentage of supervisors' time spent on the activities; supervising drivers and other assignments. The secondary cost driver is the percentage of time that the activities are performed within or outside the system. Finally the cost objects are within studied system and outside studied system.



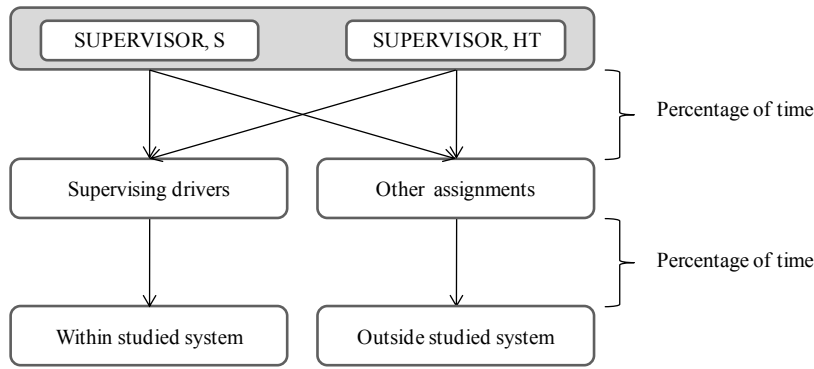


Figure 26. ABC structure for annual cost of supervising within studied system (S = Steel, HT = Heat Treatment) (modified Gerdin, 1995)

Formula 5 was used to calculate the annual cost, within the studied system, for the supervisors.

$$\begin{aligned}
 &Cost_{Supervisors\ within\ studied\ system} \\
 &= Percentage\ of\ time\ spent\ on\ supervising_{Supervisor,S} \\
 &\times Percentage\ of\ time\ supervising\ within\ studied\ system_{Supervisor,S} \times Cost_{Supervisor,S} \\
 &+ Percentage\ of\ time\ spent\ on\ supervising_{Supervisor,HT} \\
 &\times Percentage\ of\ time\ supervising\ within\ studied\ system_{Supervisor,HT} \times Cost_{Supervisor,HT}
 \end{aligned}$$

Formula 5. Cost of supervising within studied system (S = Steel, HT = Heat Treatment)

The last research question concerning additional overhead costs was:

- *What is the total annual cost of buildings concerning the studied system?*

The cost items included in the cost of buildings are rent of the land as well as repairs and maintenance and cleaning services for the buildings. These three cost items were retrieved from SAP. The Financial Controller could state the land area as well as the size of the building and the office.

The ABC structure used is illustrated in Figure 27. The resource in this structure is the building. The primary cost driver is the percentage of building area used by the activities; office and other building areas. The secondary cost driver is the percentage of the building area that is part of the studied system. Finally, the cost objects are within studied system and outside studied system.

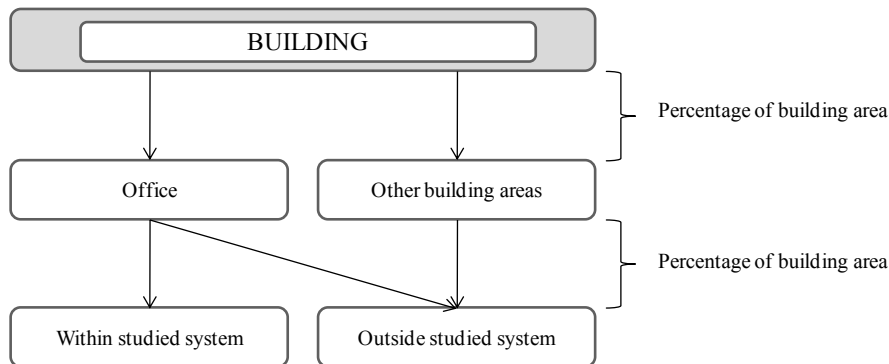


Figure 27. ABC structure for annual cost of buildings within studied system (modified Gerdin, 1995)

Formula 6 was used to calculate the annual cost, within the studied system, for buildings.

$$\begin{aligned}
 &Cost_{Buildings\ within\ studied\ system} \\
 &= Percentage\ of\ building\ used\ for\ office \\
 &\times Percentage\ of\ office\ within\ studied\ system \times Cost_{Building\ related\ cost\ items}
 \end{aligned}$$

Formula 6. Cost of building expenses within the studied system

#### 5.3.4 CALCULATION OF TOTAL TRANSPORTATION COST

When the fixed, variable and overhead costs had been determined, the total transportation cost for the current situation could be calculated. By using the total transportation cost model developed in the task specification, see Figure 20 and Formula 7 below, the total cost for the current situation was determined. The result is presented in Section 6.1.4.

$$Total\ Transportation\ Cost = \sum Fixed\ Costs + \sum Variable\ Costs + \sum Overhead\ Costs$$

Formula 7. Total transportation cost, based on Rushton et al.'s (2006) theory of total transportation cost

#### 5.4 DESCRIPTION OF THE CURRENT SITUATION: DISTRIBUTION STRUCTURE



The Description of the current situation: Distribution structure is the second step in the methodology structure, see Figure 21. In the task specification, several research questions concerning this step have been developed. To answer these questions, both primary and secondary data have been collected from ASSAB Singapore. Data compiled in several Excel files retrieved from SAP concerning ASSAB Singapore's sales and customers during 2009, serves as the basis for this data collection. The data was retrieved in collaboration with ASSAB Pacific's IT Manager.

As a first step, the customers' localization was considered and a number for each customer's corresponding transportation region was introduced to the sales data.

- Region 1: Jurong
- Region 2: Town
- Region 3: Ang Mo Kio & Woodlands (AMK &WDL)

For the Excel file to further meet the requirements to serve as a basis for the description of the studied distribution structure three adjustments had to be made. At first, all international sales were deleted since these do not generate any local transportation between the distribution center and a customer in Singapore. Secondly, all transactions stated as cash on delivery with customers lacking a notation for the region were deleted from the Excel file. This was made since these orders were assumed to be picked up by the customer at ASSAB Singapore's distribution center, i.e. these orders did not generate any type of delivery for ASSAB Singapore. Thirdly, all heat treatment orders were duplicated to illustrate the fact that these orders generate two transports, one delivery from customer to ASSAB Singapore and a second one from ASSAB Singapore back to the customer. To take allocation of orders, several orders that constitute one single delivery, into consideration the bill numbers and not the separate orders were analyzed. The following paragraphs elaborate the different methods that have been used while answering the corresponding research questions.

To localize ASSAB Singapore's customers, the following question was analyzed further:

- *How many customers does ASSAB Singapore supply in the different regions?*

In order to answer the question, the IT Manager at ASSAB Pacific was consulted to retrieve the customer information from SAP. The data contained information about which region each customer was located in, and the number of customers within each region could thereby be calculated.

In order to find out how frequently customers within a region are supplied as well as how big the sales value of the goods delivered within a region was, the following two research questions were analyzed further:

- *How frequently does ASSAB Singapore deliver goods to customers within a region?*
- *How big is the sales value within a region?*

When answering these two questions, the IT Manager at ASSAB Pacific was consulted. The information needed was retrieved from SAP. The number of deliveries performed within a region was based on the number of bill orders during 2009. The frequency was first analyzed per customer, and later summarized for each region. As for the delivery frequency, the sales value was first identified per customer and later compiled per region.

To evaluate the credibility of the number of deliveries calculated the Operations Manager was asked for the number of deliveries performed by the steel truck each day. In turn the Heat Treatment Manager was asked to make an estimation of the daily number of heat treatment deliveries.

Concerning ASSAB Singapore's total weight of deliveries the following question was answered by conferring SAP documented sales volumes and coordinating the data with the customers' localization data.

- *How big is the sales volume within a region?*

While analyzing ASSAB Singapore's sales volume, all orders from 2009 were retrieved from SAP with assistance from ASSAB Pacific's IT Manager. The sales volume of each order was then compiled in order to retrieve the total sales volume per region.

In the task specification these four questions concerning the dispersion of weights and lengths were also developed:

- *What is the maximum and minimum delivery weight?*
- *What is the maximum length of products sold?*
- *What is the average and median delivery weight?*
- *What is the average length of products sold?*

To answer these questions ASSAB Singapore's orders from 2009 were retrieved from SAP and transferred into an Excel sheet. The data was retrieved by assistance from ASSAB Pacific's IT Manager. Through calculations and allocations of orders in the Excel file the questions were answered.

## 5.5 REQUEST FOR QUOTATION



The Request for Quotation composes the third step in the methodology structure illustrated in Figure 21. This section aim to clarify how the data needed, when constructing an RFQ, was collected. The data needed was both primary and

secondary data. Interviews had to be performed at the sales department, the administration and accounting department as well as with the management at ASSAB Singapore and ASSAB Pacific. The Managing Director at Uddeholm KK in Japan, was also consulted for information and advice.

When constructing an RFQ there are several things to take into consideration, see Section 3.7.2. In Section 4.6, research questions were developed in order to clarify the data that had to be collected to construct an RFQ for this study. The following paragraphs will clarify how the data was collected as well as where it was collected from.

An RFQ should include a description of the products, see Section 3.7.2. The description declares if there are any particular considerations concerning the handling of the products. When ASSAB Singapore's products have been processed by the customer or heat treated at the distribution center, more value has been added to the products. It has therefore been crucial to state if the steel or the heat treated products must be handled with any particular consideration in the RFQ. The following research question has therefore been posed to the supervisors responsible of the steel and heat treatment departments at ASSAB Singapore. The supervisors are responsible for the company's routines and have therefore the answer to this question.

- *Are there any special considerations to be taken into account when transporting heat treatment and steel products?*

To be able to declare how many deliveries as well as clarify the weights that are to be delivered, a weight limit for designated orders was to be set. Therefore, another important research question investigated in the study is:

- *What will be the weight limit for designated orders?*

As this is an investigative question there were no direct answers to be found within the organization. No one at ASSAB Pacific or ASSAB Singapore was able to give a direct answer to the question. In order to answer it, consultation from ASSAB Pacific's managements as well as from the Managing Director of Uddeholm KK in Japan, was needed.

The process used when setting weight limits for designated orders in this study can be divided into three steps:

1. Collecting and analyzing order data from ASSAB Singapore
2. Comparing the analyzed data with data received from Uddeholm KK, Japan
3. Deciding weight limits in cooperation with ASSAB Pacific's management

The weight dispersion data collected from ASSAB Singapore was from January to December 2009. The decision to analyze one full year was made to not disregard seasonal changes in demand and number of customers. After compiling and analyzing ASSAB Singapore's order weight distribution, it was compared to Uddeholm KK's data. As mentioned in Section 1.1, all transports on the Japanese market are performed by forwarding agents why Uddeholm KK's Managing Director has good insight in this area. The Managing Director was able to declare the weight distribution of Uddeholm KK's orders as well as the weight limits that the company has set for different groups of orders.

The management of ASSAB Pacific was thereafter consulted and weight limit decisions concerning three scenarios were taken. The management was consulted since they requested this investigation, and therefore should be able to take part in important decisions throughout the study.

The management of ASSAB Pacific was also consulted concerning the length of the contract. The following research question was posed:

- *For how long period of time should the contract run?*

Besides the weight limits and the duration of the contract, the RFQ also includes different delivery service demands. In order to find out ASSAB Singapore's delivery service demands, the following questions were posed to ASSAB Pacific's management:

- *What demand of delivery reliability does ASSAB Singapore require from a forwarding agent?*
- *What delivery lead time demand does ASSAB Singapore require from a forwarding agent?*

When the actual construction of the RFQ was finished research questions regarding which forwarding agents to send it to had to be answered. The following questions were posed:

- *Which are the most important criteria for ASSAB Singapore when selecting forwarding agents for the RFQ process?*
- *Which forwarding agents live up to the criteria set by ASSAB Pacific?*
- *To which forwarding agents will the RFQ be sent?*

In order to identify important criteria when selecting forwarding agents for ASSAB Singapore's RFQ process, Pewe et al.'s (2002) twelve criteria were narrowed down to six criteria in the task specification. The six criteria were thereafter presented to ASSAB Pacific's management. The management was asked to prioritize the criteria. The prioritization was performed during a semi-structured interview, which according to Björklund et al. (2003) is an interview where a number of questions are set before the interview, while some questions arise along the interview. The prioritization of the criteria meant that the management stated which criteria that are regarded as critical concerning ASSAB Singapore's operations and which criteria that are not as important.

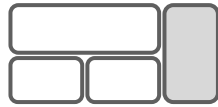
When the criteria had been prioritized, a deeper investigation of potential forwarding agents had to be performed. The investigation started broad and a number of forwarders could be excluded due to either information found on the Internet or after phone calls to the forwarders. The remaining forwarders, which probably would be able to do the work, were assembled in a short list, see Table 14. From the short list three suitable forwarders were selected with consideration to the prioritized criteria and the final forwarder selection was performed. The selected forwarders fulfilled the criteria in the most satisfying way and were therefore also believed to perform the job in the best way.

To summarize, when developing the criteria and selecting forwarding agents for the RFQ process, the following process was used:

1. Literature reviews were performed in order to find criteria. Twelve criteria were identified.
2. Twelve were narrowed down to six in the task specification.

3. The criteria were prioritized in cooperation with ASSAB Pacific's management.
4. A short list of forwarders was assembled after investigating the prioritized criteria.
5. The three forwarding agents that fulfilled the criteria to the greatest extent were chosen for the RFQ process.

## 5.6 EVALUATION OF FORWARDERS' QUOTES



After the forwarding agents had received an RFQ and placed their quotes, the forth step in the methodology structure, the Evaluation of forwarders' quotes, began. The evaluation of forwarders' quotes was divided into several steps. First, each quote had to be analyzed with respect to the offered prices. The research questions posed during this first phase of the evaluation were as follows:

- *What are the base prices for designated orders in the forwarding agents' quotes?*
- *What is the price addition concerning cost fluctuations in fuel?*
- *What is the price addition concerning fluctuations in number of designated orders?*

The offers received from the forwarding agents were compared to each other in order to find out which forwarder's offer that was most beneficial for ASSAB Singapore. Depending on the combination of base price and additional prices stated in the three different quotes the following question could be answered:

- *What is the current total transportation cost for designated orders?*

These four questions stated above were analyzed for each quote separately. Thereafter a comparison of the total price given as quotes from different forwarders had to be made in order to see if there were any of the forwarders' quotes that stood out from the other two; answering the following question:

- *What are the variations in price among the forwarding agents' quotes?*

Due to the result of the current total transportation cost and the retrieved quotes, see Table 16, the last three research questions have not been investigated further. The reasons for this are further discussed in Section 6.4.

- *What is the current total transportation cost for designated orders?*
- *What is the total transportation cost when complementing current transportation mode with forwarding agents?*
- *What is the difference in total transportation cost between the current transportation mode and a transportation mode complemented by forwarding agents for designated orders?*

## 5.7 QUALITY ASSURANCE

According to Björklund et al. (2003), *objectivity*, *validity* and *reliability* are three dimensions that measure a study's credibility. In order to achieve credibility in this study, these concepts have been analyzed. A discussion upon how objectivity, validity and reliability have been achieved in the study follows below.

### 5.7.1 OBJECTIVITY

*Objectivity* is defined as to what extent interpretations and subjective assessments affect a study (Björklund et al., 2003). In order to achieve objectivity, different methods have been used in this study. First of all, different types of resource material have been retrieved. By referring to research both published in books and articles, a broad perspective without subjective judgments was created. Furthermore, while collecting company data, different persons within the company were interviewed. This approach decreased the risk of only including one person's picture of the studied system. Besides this, leading questions were avoided when interviewing employees at the company, why further objectivity was achieved.

When calculated the overhead costs, the theory of Activity Based Costing was applied. This theory is connected to some subjective assessments when estimating time spent on different activities. This might have affected the result. However, the ABC theory is one of the most objective and accurate methods when determining overhead costs, see Section 3.8. Furthermore it was a necessity to make estimations regarding the time spent on different activities. When calculating overhead costs, the ABC theory is trustworthy in comparison to traditional calculation schemes why the objectivity has been maintained.

Furthermore, all data retrieved from different persons at ASSAB Singapore's distribution center was reviewed and reflected in order to evaluate its credibility. It was important to assure that subjective assessments were avoided, but also that the information retrieved from the company was correct. The results were re-counted and cost items included in the total cost model for ASSAB Singapore were questioned. Thereby, further objectivity was contributed to the study.

Objectivity was also maintained when scanning the market to find relevant criteria and potential forwarding agents for the study. Three different types of forwarders were found on the market which assured that no important parts of the market were left behind. The persons performing the search, i.e. the authors of this report, had no linkage to forwarding agents in Singapore, and they were therefore totally neutral when scanning the market. ASSAB Pacific stayed consciously outside this process, why the study was not affected by existing information within the company.

The third step in ASSAB Singapore's transport purchasing process involves construction of the RFQ. The RFQ was constructed in order to provide each of the potential forwarders with the same information at the same time. Thereby objectivity was achieved since favoring of any specific forwarder was avoided.

### 5.7.2 VALIDITY

*Validity* is defined as to what extent one measures what one intends to measure (Björklund et al., 2003). Therefore multiple references for the different areas were searched and compiled in Chapter 3. In Section 3.1, only one author has been used. This has not been an active choice but a result of no other sources addressing the subject having been found.

Björklund et al. (2003) state that validity is achieved when viewing the task using different perspectives. To strengthen the validity of this study the transport infrastructure perspective, the transporter supplier's perspective as well as the transport buyer's perspective have been evaluated when considering the total cost model for the study. As presented in Section 4.4.1, the transport supplier's perspective was then chosen after thorough deliberations.

To preserve the validity also when scanning the market for potential forwarding agents to handle ASSAB Singapore's deliveries, different parts of the market have been investigated. The different types have been investigated before sending out the RFQ to ensure that the forwarders were able to perform the deliveries intended to receive quotes on.

Concerning the description of the current situation, the number of deliveries that was retrieved as primary data from SAP for 2009 was evaluated to ensure that no misinterpretations had been made. This evaluation was made by letting the Operations Manager and the Heat Treatment Manager calculate and estimate the number of deliveries per day respectively. Since the interpreted data from SAP and the result from the managers correlated it could be concluded that the interpretations were valid.

### 5.7.3 RELIABILITY

*Reliability* is defined as the extent of credibility in the measuring device, i.e. in what extent one would achieve the same value if the investigation was repeated. (Björklund et al., 2003) To achieve reliability in this study the original source of research has been used at all time. By returning to the original source, interpretations made by other authors have been delimited. The reliability has also been sustained by using a methodology based on a theoretical purchasing method that has been used and evaluated by researchers. Such a method is likely to include all necessary steps for a comprehensive study.

If this study would be repeated, the most critical steps would be the data collection and data processing since these processes involve taking a lot of decisions and making estimations. Therefore, to maintain reliability, the procedures for all involved steps have been declared in the report. This action facilitates the understanding of the decisions taken throughout the study and the probability to achieve the same value if the investigation was repeated is increased.

To uphold the reliability all transportation costs presented by Pewe et al. (2002) and Rushton et al. (2006) have been evaluated. Cost elements have only been excluded if they have been irrelevant to ASSAB Singapore, as for example the cost of telephone when the company uses walkie-talkies when communicating with drivers. Further a sensitivity analysis will be performed where there are uncertainties to evaluate the reliability of the result.

At last, to increase the total credibility, objectors have continuously reviewed the objectivity, validity as well as the reliability throughout this study.



## 6 EMPIRICAL RESULTS

*In this chapter the empirical results are presented. The results concern the four areas; Description of the current situation: Total transportation cost, Description of the current situation: Distribution structure, Request for Quotation and Evaluation of forwarders' quotes. Each research question developed in Chapter 4, quantitative as well as qualitative, is here answered under its corresponding section.*

### 6.1 DESCRIPTION OF THE CURRENT SITUATION: TOTAL TRANSPORTATION COST

In this section, the empirical results when calculating the total transportation cost for the current situation are presented. The results for fixed, variable and overhead transportation costs are first presented independently and thereafter jointly in order to get an overview of each part of the total cost as well as the final result. All calculations are based on historical data from January to December 2009.

#### 6.1.1 FIXED TRANSPORTATION COSTS

In this section, ASSAB Singapore's fixed transportation costs are presented. Regarding the company's vehicles, it is only the ten feet truck and the three vans that comprise fixed cost of vehicles. The 14 feet spare truck is discussed in Section 0, since it is regarded as back-up equipment and thereby an overhead cost. The research questions regarding fixed transportation costs are presented below and the quantitative results are illustrated in Table 2, see page 57.

- *Are ASSAB Singapore's vehicles depreciated?*

ASSAB Singapore's Financial Controller stated that the company depreciates vehicles over five years. Since the truck was purchased in 2002, it was fully depreciated already in 2006. The vans on the other hand were purchased in 2005 and the last depreciation was made in January 2009.

- *How big is ASSAB Singapore's vehicle depreciation per year?*

Since the vans are fully depreciated today the former depreciation cost will not affect the company the following years and has therefore been set equal to zero. A further discussion concerning the depreciation cost is held in the sensitivity analysis see Section 8.2.1.

- *How much does ASSAB Singapore pay for vehicle insurance annually?*

Each owned vehicle generates a certain amount of vehicle insurance. For example, the insurance vary depending on how old and big the vehicle is. The total yearly cost for the vehicle insurance is SGD 4 428.

- *What is the total cost for the drivers per year considering salaries, pensions, holiday pays and insurances?*

The Financial Controller stated that the drivers do not get any extra payments for holidays, why this cost was excluded from the total cost calculation. On the other hand, there were other fixed costs regarding the drivers that had to be taken into consideration. These cost items are *medical expenses, skill development fund (SDF), hardship allowance, public transport, bonuses and annual wage supplement*.

All employees working for ASSAB Singapore receive a fixed amount to cover medical expenses every year. This cost item must therefore be included in total fixed cost. Furthermore, ASSAB Singapore sometimes sends their employees on further training. Hence, costs regarding the skill development fund

arise. Hardship allowances are additional payments for working under adverse conditions. The drivers get compensations for their work conditions why it must be included in the total costs. Furthermore, the drivers also get compensation for public transport and receive bonuses every year. At last, some of the drivers have an additional months pay in their contract called an annual wage supplement. 2009 was a special year when considering salaries since the whole company agreed to accept a four-day working week to lower the company's costs. To make the cost data representative for upcoming years the lowered salaries were disregarded and the total cost for the drivers was calculated for a five-day working week. The annual cost generated by the drivers is SGD 104 660, see Table 1. All the driver related cost items have been included in the total cost calculation.

Table 1. Total cost generated by the drivers during 2009

<b>DRIVERS' COST</b>	<b>[SGD]</b>
Drivers' salaries	70 320
Drivers' Pensions Fund, CPF	12 162
Drivers' holiday pays	0
Drivers' insurances	2 007
Drivers' medical expenses	1 600
Drivers' Skill Development Fund, SDF	223
Drivers' hardship allowance	2 400
Drivers' public transport	960
Drivers' bonus	10 478
Drivers' licenses	0
Drivers' annual wage supplement	4 510
<b>TOTAL DRIVERS' COSTS</b>	<b>104 660</b>

- *Does ASSAB Singapore pay for the drivers' licenses?*

ASSAB Singapore does not pay for the drivers' licenses.

- *How much does ASSAB Singapore pay for the drivers' licenses annually?*

Since ASSAB Singapore does not pay for the drivers' licenses, no costs regarding this item have arisen.

- *Does ASSAB Singapore have a garage or external parking lots for the vehicles?*

ASSAB Singapore does not have a garage or any external parking lots.

- *What is the total cost for the garage or external parking lots per year?*

ASSAB Singapore does not pay anything for garage or external parking lots since the drivers park the vehicles at their homes. If it costs anything to park the vehicles, the drivers have to pay that fee themselves. Hence, no fixed costs concerning garage or parking lots arise for ASSAB Singapore.

- *How much does ASSAB Singapore pay in fixed vehicle tax per year?*

Vehicle tax does not exist in Singapore, why ASSAB Singapore does not have any costs concerning this cost item. On the other hand, they have to pay *road tax*. Each vehicle generates a certain amount of road tax, in total SGD 1 557 in 2009, why this has been included in the total fixed cost.

- *How much does ASSAB Singapore pay for the subcontracted vehicle per year?*

ASSAB Singapore pays a fix amount of SGD 6 900 each month, i.e. SGD 82 800 annually, for the subcontracted vehicle. This price includes everything, drivers, fuel, insurances etcetera. Consequently, no additional costs regarding this vehicle arise.

When the research questions had been posed, the Financial Controller added two cost items that should be included in the total fixed transportation cost; cost for *radio licenses*, SGD 108, and *walkie-talkies*, SGD 2 352. The cost of radio licenses is due to the radios installed in the vehicles and the walkie-talkies are used when communicating with the drivers when they are out on their routes. These cost items were therefore included in the total fixed transportation cost.

Table 2. Fixed transportation costs for ASSAB Singapore during 2009

FIXED TRANSPORTATION COST	[SGD]
Vehicle depreciation	0
Vehicle insurance	4 428
Drivers' salaries	70 320
Drivers' Pensions Fund, CPF	12 162
Drivers' holiday pays	0
Drivers' insurances	2 007
Drivers' medical expenses	1 600
Drivers' Skill Development Fund, SDF	223
Drivers' hardship allowance	2 400
Drivers' public transport	960
Drivers' bonus	10 478
Drivers' annual wage supplement	4 510
Drivers' licenses	0
Garage or parking lots	0
Fixed vehicle tax	0
Road tax	1 557
Subcontracted vehicle	82 800
Radio license	108
Walkie-talkies	2 352
<b>TOTAL FIXED COSTS</b>	<b>195 906</b>

When summarizing all the fixed transportation costs, the yearly cost for ASSAB Singapore is SGD 195 906, see Table 2.

### 6.1.2 VARIABLE TRANSPORTATION COSTS

In this section, ASSAB Singapore's variable transportation costs are presented. The research questions regarding variable transportation costs are presented below and the quantitative results are illustrated in Table 3, see page 59.

- *What is the total fuel cost per year?*

The cost of fuel for the company owned trucks and vans constitutes SGD 16 216.

- *How much does ASSAB Singapore pay for repairs and maintenance of the vehicles annually?*

The cost for repairs and maintenance of the vehicles constitutes SGD 12 322.

- *Does ASSAB Singapore compensate their drivers when working overtime?*

ASSAB Singapore do compensate their drivers for overtime. The drivers' routes sometimes take longer time to complete due to increased demand and they are then compensated for the extra time they need to perform the deliveries.

- *How much does ASSAB Singapore pay for drivers' overtime annually?*

During 2009 the drivers' overtime generated a cost of approximately SGD 3 522. This is the third largest cost item of variable transportation costs.

- *What is the annual cost for lubricants used by the vehicles?*

The cost for lubricants is included in the repairs and maintenance account. According to ASSAB Singapore's Financial Controller, they do not separate these cost items. Hence, the cost for lubricants is included in the account repairs and maintenance in Table 3.

- *What is the total cost for tire wear per year?*

As for the lubricants, the cost for tire wear is included in the account repairs and maintenance. The result is presented in Table 3.

- *How much does ASSAB Singapore pay in running vehicle tax per year?*

No running vehicle tax has to be paid in Singapore. Hence, this cost item is equal to zero.

When the research questions had been posed, the Financial Controller added one cost item that should be included in the total variable transportation cost; *garage and parking fees*. It includes fees imposed when the vehicles have to enter a parking lot or a garage to deliver goods to the customers. During 2009 this cost was SGD 284.

Table 3. ASSAB Singapore's variable transportation costs during 2009

VARIABLE TRANSPORTATION COSTS	[SGD]
Fuel	16 216
Repairs & Maintenance (Lubricants and Tire wear included)	12 322
Drivers' overtime	3 522
Running vehicle tax	0
Garage and parking fees	284
<b>TOTAL VARIABLE COSTS</b>	<b>32 344</b>

When summarizing the variable transportation costs, the yearly cost for ASSAB Singapore is calculated to be SGD 32 344, see Table 3.

### 6.1.3 OVERHEAD TRANSPORTATION COSTS

The overhead transportation costs include the cost of back-up equipment, back-up personnel, salary payments, invoice payments, supervising and buildings within the studied system. In the following paragraphs the empirical result of the overhead costs are declared separately after each of the five research questions. The total overhead transportation costs are thereafter compiled in Table 4, see page 63.

- *What is the annual cost of the back-up equipment generated by the studied system?*

The estimated time consumption of the back-up equipment, i.e. the back-up truck, is illustrated in Figure 28. The Operations Manager estimated the back-up truck to be used 50 percent for transports within system, while it was not in use 45 percent of the time and used for other transports outside system during the remaining five percent of the time.

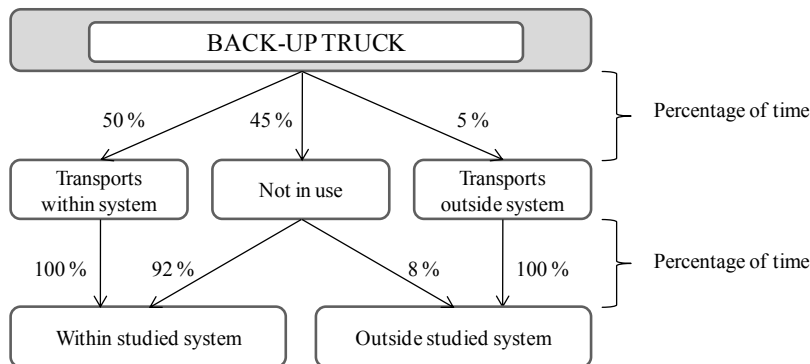


Figure 28. Estimated consumption of time for back-up equipment (modified Gerdin, 1995)

The estimated time consumption for the back-up equipment gave that 91 percent of the cost for the back-up truck fell within the studied system, see Formula 8.

*Percentage of the cost of back – up truck within studied system* =  $50 \% \times 100 \% + 45 \% \times 92 \% = 91 \%$

Formula 8. Percentage of the cost of back-up truck within studied system

By using Formula 1 the annual cost of the back-up equipment generated by the studied system was calculated to be SGD 5 192.

- *What is the annual cost for back-up personnel?*

The back-up personnel consists of one back-up driver. It was estimated that this driver spent 30 percent of his working hours on deliveries during 2009, see Figure 29. All deliveries that the back-up driver performs are within the studied system.

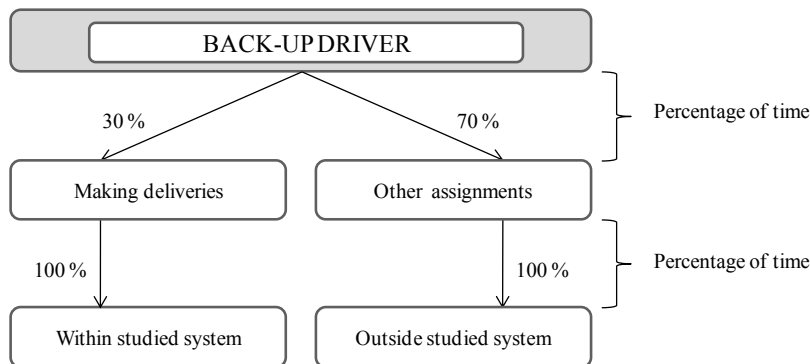


Figure 29. Estimated time spent by back-up drivers within studied system (modified Gerdin, 1995)

The estimation gave that 30 percent of the cost for the back-up driver fell within the studied system. By using Formula 2 the annual cost of the back-up personnel generated within the studied system was calculated to be SGD 8 551.

- *What is the total administrative cost per year considering processing of salary payments?*

The estimated time spent on salary payments by the Salary Administrator, within the studied system, is illustrated in Figure 30. One day out of 22 working days per month, i.e. five percent of the administrators time, is spent on salary administration. Furthermore, there are 50 employees, i.e. 50 salaries paid, out of which four to the company drivers. This leads to eight percent of the Salary Administrator's time being consumed within the studied system.

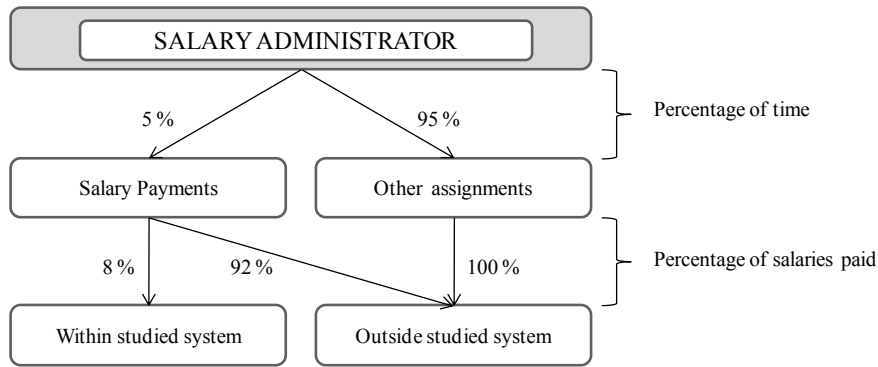


Figure 30. Estimated time spent by Salary Administrator within studied system (modified Gerdin, 1995)

The estimations gave that 0.37 percent of the cost for the Salary Administrator fell within the studied system. By using Formula 3 the annual cost of salary payments, generated by the studied system, was calculated to be SGD 217.

- *What is the total administrative cost per year considering processing of invoice payments?*

The time consumed on invoice payments by the Accounting Clerk, within the studied system, is illustrated in Figure 31. The Accounting Clerk spends all its time on accounting activities. During 2009 approximately 2 200 invoices were processed out of which 400, 19 percent, concerned the studied system.

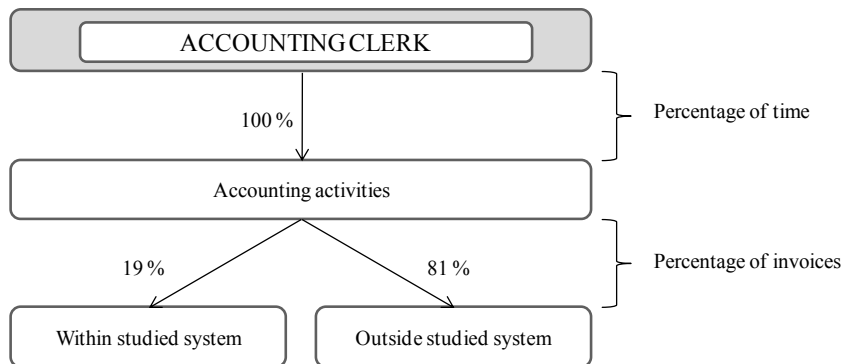


Figure 31. Estimated time spent by Accounting Clerk within the studied system (modified Gerdin, 1995)

In total, 18 percent of the cost for the Accounting Clerk falls within the studied system. By using Formula 4 the annual cost of invoice payments was calculated to be SGD 4 031.

- *What is the total annual cost of supervising concerning the studied system?*

There are two supervisors for the drivers, one supervising the steel driver and one supervising the three heat treatment drivers. The steel supervisor estimates that he spends eleven percent of his time supervising the steel driver, see Figure 32. The heat treatment supervisor on the other hand estimates that he spends 60 percent of his time on supervising.

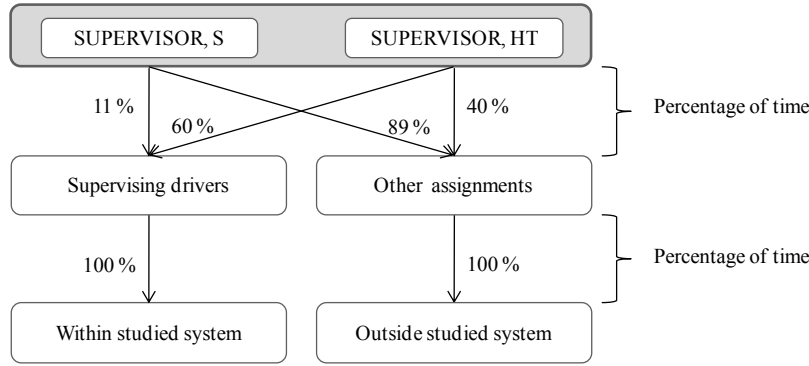


Figure 32. Estimated time consumed by supervisors within the studied system (S = Steel, HT = Heat Treatment) (modified Gerdin, 1995)

The estimations gave that eleven and 60 percent of the cost for the steel and heat treatment supervisors respectively fell within the studied system. Further, Formula 5 gave that the annual cost of supervisors, within the studied system, is equal to SGD 24 978, approximately 59 percent of the total overhead cost.

- *What is the total annual cost of buildings concerning the studied system?*

ASSAB Singapore owns its building and rents the property on which it is placed. The office occupies 19 percent of the building area and in the office the Accounting Clerk and the Salary Administrator perform activities within the studied system. Since the Salary Administrator only spends 0.37 percent of her time on these activities she has been delimited from this calculation. Therefore only the Accounting Clerk was kept in the calculation, i.e. one of 20 office employees, and she spends 18 percent of her time within the studied system, i.e. 0.9 percent in total.

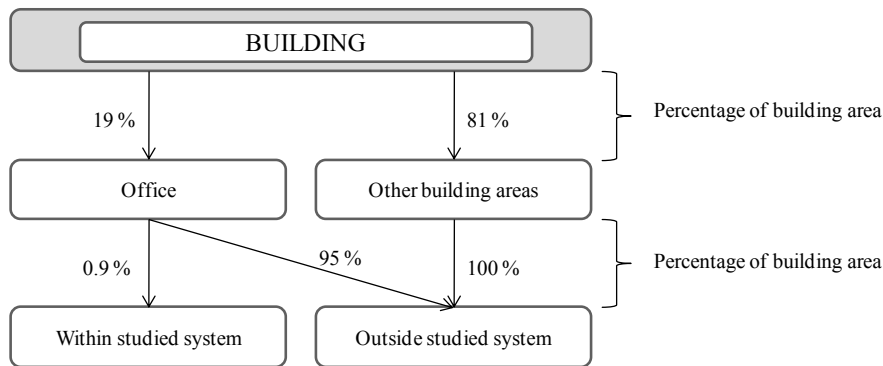


Figure 33. Area of building used within studied system (modified Gerdin, 1995)

Formula 9 gave that 0.2 percent of the building costs were within the studied system.

$$\text{Percentage of the cost of building within studied system} = 19\% \times 5\% \times 18\% = 0.2\%$$

Formula 9. Percentage of the cost of building within studied system

By using Formula 6 the annual cost of buildings within the studied system was calculated to be SGD 233.

At last, the total overhead transportation cost could be calculated. Addition of the costs of back-up equipment, back-up personnel, salary payments, invoice payments, supervision and building within the studied system generated a total overhead transportation cost of SGD 43 201, see Table 4.



Table 4. ASSAB Singapore's overhead transportation costs during 2009

OVERHEAD TRANSPORTATION COSTS	[SGD]
Back-up equipment	5 192
Back-up personnel	8 551
Salary payments	217
Invoice payments	4 031
Supervisors salaries	24 978
Building	233
<b>TOTAL OVERHEAD COST</b>	<b>43 201</b>

#### 6.1.4 CALCULATION OF THE TOTAL TRANSPORTATION COST

When the fixed, variable and overhead transportation costs had been determined, the total transportation cost for ASSAB Singapore was calculated. The total transportation cost for 2009 was SGD 271 450, see Table 5.

Table 5. Total transportation cost for ASSAB Singapore

	[SGD]
Total fixed transportation costs	195 906
Total variable transportation costs	32 344
Total transportation overhead costs	43 201
<b>TOTAL TRANSPORTATION COSTS</b>	<b>271 450</b>

The fixed transportation costs are significantly larger than the variable and overhead costs, see Diagram 6. The fixed costs comprise about 72 percent of the total transportation cost, while the variable and overhead costs comprise 12 percent and 16 percent respectively.

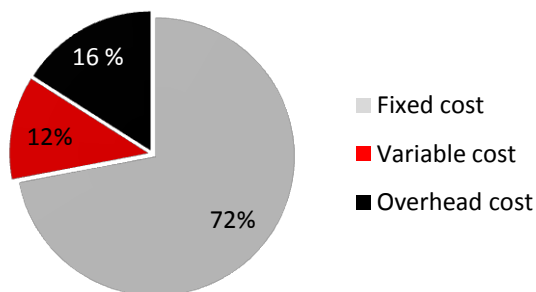


Diagram 6. The three cost elements' part of the total transportation cost

## 6.2 DESCRIPTION OF THE CURRENT SITUATION: DISTRIBUTION STRUCTURE

In this section the empirical result for the distribution structure is presented. The empirical result corresponding to each research question is stated below.

- *How many customers does ASSAB Singapore supply in the different regions?*
- *How frequently does ASSAB Singapore deliver goods to customers within a region?*

Table 6. ASSAB Singapore's number of customers and deliveries in 2009, both presented per region

REGION	CUSTOMERS [NBR]		DELIVERIES [NBR]	
Jurong	103	31 %	5 911	38 %
Town	137	41 %	4 744	31 %
AMK & WDL	92	28 %	4 692	31 %
TOTAL	332	100 %	15 347	100 %

During 2009 ASSAB Singapore supplied in total 332 customers localized in Singapore. Of these, 31 percent were localized in Jurong, 41 percent in Town and 28 percent in Ang Mo Kio & Woodlands. Furthermore, the company's Singaporean customers placed orders resulting in a total of 15 347 deliveries during 2009, approximately 59 deliveries per day. This figure correlated to the figures that were calculated and estimated by the Operations Manager and the Heat Treatment Manager respectively. As can be read in Table 6, Town has the highest number of customers but these customers generate, on average, fewer deliveries than Jurong. Ang Mo Kio & Woodlands on the other hand, has approximately the same percentage of customers and deliveries.

- *How big is the sales value within a region?*
- *How big is the sales volume within a region?*

Table 7. Sales value and sales volume for ASSAB Singapore in 2009

REGION	SALES VALUE [SGD]		SALES VOLUME [KG]	
Jurong	2 733 111	33 %	233 638	33 %
Town	2 200 150	26 %	180 942	25 %
AMK & WDL	3 416 894	41 %	305 351	42 %
TOTAL	8 350 155	100 %	719 931	7%

During 2009 the sales value and volume delivered were distributed in a similar matter over the three regions. This indicates that the three regions' customers on average order material with a similar value per kilogram. While reading these figures it is important to remember that they show the delivered sales value and volume of products, not the actual sales. This means that for example the sales volume in Table 7 indicates the total weight of products moved once between ASSAB Singapore and a Singaporean customer within a certain region. Comparing Table 6 and Table 7 gives that Town, having the greatest number of customers, has the least value and volume delivered during 2009. This while Ang Mo Kio & Woodlands has 28 percent of the customers and generates 41 percent of the value and 42 percent of the volume throughout the same period of time.

- *What is the maximum and minimum delivery weight?*

- *What is the average and median delivery weight?*

In 2009 the total weight of products delivered within Singapore was approximately 720 tons for ASSAB Singapore, see Table 8. The data analysis indicates a wide range of delivery weights. Products delivered range between 48 grams and 7.67 tons. The average weight of 47 kilograms and the median of 13 kilograms indicate that there are many small deliveries made to individual customers.

Table 8. Key figures concerning delivery weights distributed by ASSAB Singapore in 2009

DELIVERY WEIGHT	[KG]
Maximum	7 670
Minimum	0,048
Average	47
Median	13
Total	719 931

- *What is the maximum length of products sold?*
- *What is the average length of products sold?*

Table 9. Key figures concerning lengths of products delivered by ASSAB Singapore in 2009

LENGTS	[MM]
Maximum	10 000
Average	218

In 2009 the maximum length of a product delivered by ASSAB Singapore was ten meters while the average length was only 0.218 meters, see Table 9. As for the delivery weights there is a wide range of product lengths distributed by the company.

### 6.3 REQUEST FOR QUOTATION

In this section, data and information gathered for the RFQ is compiled. The data presented is based on the data collection described in Section 6.2. The results that are presented in the section have served as a basis for the RFQ presented in Appendix VII.

The empirical result corresponding to each research question is stated below.

- *Are there any special considerations to be taken into account when transporting heat treatment and steel products?*

For steel deliveries in general, there are no special considerations to take into account. The exception is when the steel has undergone machine processing and the primer thereby has been removed. It is then important that the steel is sheltered from rain during delivery since the rain might damage the material.

Heat treatment products are more sensitive than the steel products since it has undergone further treatment. It is therefore important that these products are handled with care from pickup to delivery. Heat treatment products are either wrapped in plastic stretched film, plastic bags or newspapers before transportation to prevent damage to the customers' goods during delivery.

- *What will be the weight limit for designated orders?*

The order data retrieved from ASSAB Singapore's business management software SAP was analyzed and compiled into diagrams and tables. The results are illustrated in Diagram 7 and Table 10 below.

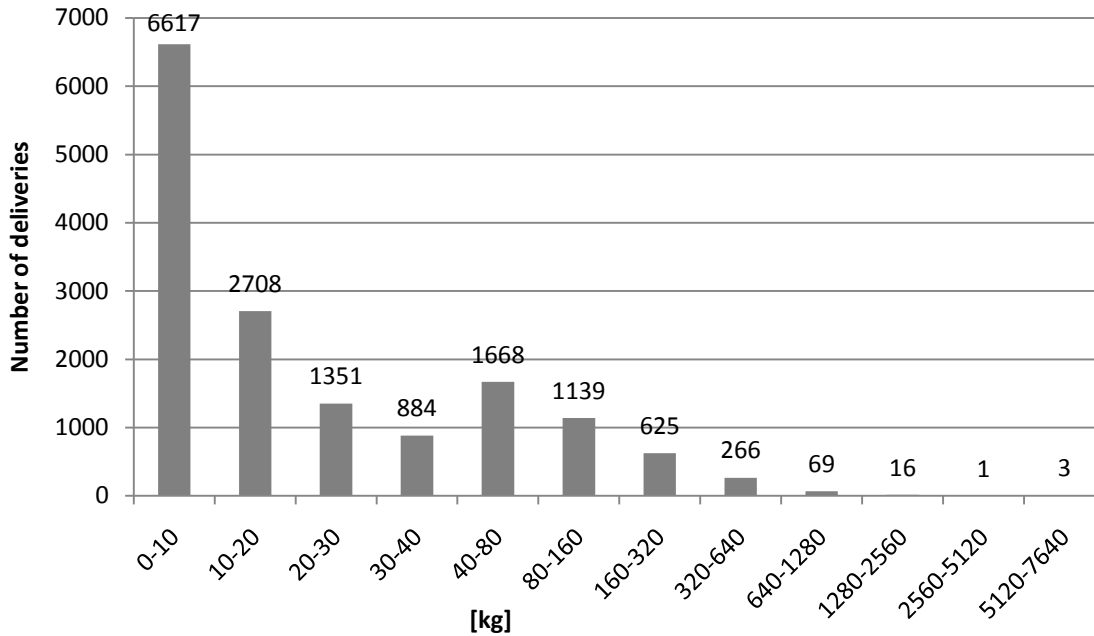


Diagram 7. Dispersion of delivery weights during 2009

As shown in Diagram 7, most of the deliveries between ASSAB Singapore's distribution center and its customers consist of small weights. There are only a limited number of deliveries that exceeds one ton. In Table 10 the exact percentage of total number of deliveries below a certain weight limit is presented.

Table 10. Delivery weights with corresponding percentage and number of deliveries during 2009

DELIVERY WEIGHT [KG]	PERCENTAGE OF DELIVERIES [%]	DELIVERIES [NBR]
≤ 10	43.12	6 617
≤ 20	60.76	9 325
≤ 30	69.56	10 676
≤ 40	75.32	11 560
≤ 80	86.19	13 228
≤ 160	93.61	14 367
≤ 320	97.69	14 992

$\leq 640$	99.42	15 258
$\leq 1\ 280$	99.87	15 327
$\leq 2\ 560$	99.97	15 343
$\leq 5\ 120$	99.98	15 344
$\leq 7\ 670$	100.00	15 347

Table 10 illustrates that approximately 43 percent of the total number of deliveries are below or equal to ten kilograms. The deliveries below or equal to 640 kilograms compose just over 99 percent of the total number of deliveries. Hence, the deliveries that exceeds one ton, about 20 deliveries per year, compose less than one percent of the total number of deliveries during 2009.

As already stated, Uddeholm KK in Japan uses subcontracted forwarding agents for all their transports. Uddeholm KK's dispersion of delivery weights and the corresponding percentage of total number of deliveries are presented in Table 11.

Table 11. Delivery weights and corresponding percentage of total number of deliveries for Uddeholm KK (Manabe, 2010)

DELIVERY WEIGHT [KG]	PERCENTAGE OF DELIVERIES [%]
$\leq 20$	25
$\leq 30$	50
$\leq 1\ 500$	90
No limit	100

When comparing ASSAB Singapore's and Uddeholm KK's delivery weight dispersion, it can be ascertained that the differences between the two subsidiaries are more extended than expected. ASSAB Singapore delivers significantly smaller weights than Uddeholm KK why these two subsidiaries are not fully comparable. Therefore, only ASSAB Singapore's own order data was used as reference when deciding weight limits for ASSAB Singapore's deliveries.

During the consultation, ASSAB Pacific's management argued that to achieve a noticeable change in the distribution structure, a big part of the deliveries will have to be contracted out. During the discussion, it was decided that three scenarios regarding the weight limit would be proposed for the forwarding agents receiving the RFQ. The first scenario was decided to include about 70 percent of the deliveries, i.e. all deliveries below and equal to 30 kilograms, see Table 10. This seemed to be a reasonable number of deliveries to outsource since it involves a major change in the distribution structure. ASSAB Pacific's management was also interested to see the result if about 85 percent of the deliveries was contracted out, hence in the second scenario the corresponding weight limit is 80 kilograms, see Table 10. At last, in the third scenario all deliveries from ASSAB Singapore's distribution center to the customers will be contracted out. These three scenarios are presented in Table 12.

Table 12. Three scenarios for different weight limits

	WEIGHT LIMIT [KG]	DELIVERIES PER YEAR [NBR]
Scenario 1	30	10 676
Scenario 2	80	13 228
Scenario 3	All deliveries	15 347

In conclusion, in the RFQ three scenarios regarding different weight limits are presented for the short listed forwarding agents. The scenarios have been developed after thorough analysis of the order data retrieved from ASSAB Singapore's business management software SAP. The forwarders have been asked to give one price quote for each scenario in order to compare the quotes between the forwarders but also to ASSAB Singapore's current transportation cost.

After the data compilation, concerning the weight limits, levels for delivery service demands were set.

- *What demand of delivery reliability does ASSAB Singapore require from a forwarding agent?*

ASSAB Singapore's customers do not accept any variations in the promised delivery lead time why the demand of delivery reliability from a forwarding agent is 100 percent. The price quotes are accordingly asked to be calculated with consideration to this demand.

- *What delivery lead time demand does ASSAB Singapore require from a forwarding agent?*

ASSAB Singapore requires that the products are delivered to the customers within the same day as the goods have been picked up. ASSAB Singapore also wants to know how much more expensive it would be if the goods are guaranteed to be delivered before noon. Hence, the forwarding agents have been asked to give two price quotes for each scenario; one price quote for deliveries reaching customers before 12:00 and another price quote for deliveries reaching customers before 18:00.

Concerning the development of the short list of forwarders the following empirical results were retrieved.

- *Which are the most important criteria for ASSAB Singapore when selecting the three forwarding agents for the RFQ process?*

As stated in Section 4.6, the following criteria from Pewe et al.'s (2002) theories must be taken into consideration when selecting forwarding agents for the RFQ process; *geographical coverage, environmental considerations, IT awareness, financial stability, tracking systems* and *historical performance*. In order to prioritize these criteria, ASSAB Pacific's management was consulted. The meeting resulted in two criteria which could be distinguished from the other four, geographical coverage and historical performance. Geographical coverage is believed to be one of the most important criteria since ASSAB Singapore's customers are located all around the Singapore Island. Forwarding agents which cannot deliver to all addresses within Singapore was thereby directly excluded from the short list. The historical performance of the forwarding agents is also believed to be an important criterion since it indicates the satisfaction level of future deliveries for ASSAB Singapore. Therefore, geographical

coverage and historical performances were paid most attention when selecting forwarding agents for the RFQ process.

Furthermore, the criterion financial stability is believed to be an important aspect when selecting forwarding agent. During the consultation with ASSAB Pacific's management it was agreed that a credit record would be collected for each potential forwarder to make sure that the financial stability would not be an issue in the future.

Environmental considerations, IT awareness and tracking systems are not believed to be as important as the other three criteria. Regarding environmental considerations, it is foremost important to secure that the future solution will not affect the environment in a more negative way. During discussions it was concluded that no forwarder would be much better than another regarding the environmental aspect. Therefore, this criterion was not taken into consideration when selecting forwarding agent. IT awareness was neither seen as the most important selection criterion when selecting a forwarder, but it should still be investigated. A forwarder can be more suitable than another if the IT system is compatible with ASSAB Singapore's business management software SAP. Therefore, information about the forwarders' existing IT systems was gathered. Since the deliveries in mind are performed within Singapore, ASSAB Pacific's management believes that tracking systems are of no interest. The deliveries within Singapore will be performed the same day as the goods are picked up why there is no need of tracking systems. Hence, the criterion tracking system was not further investigated.

In the end of the discussion, ASSAB Pacific's management was asked whether there were any criteria that they were missing among the six criteria already mentioned. Two new criteria, special for ASSAB Singapore's needs, were thereby presented; the possibility to *sign electronically* at delivery as well as the possibility to handle *cash on delivery*. The criterion cash on delivery is important to investigate since ASSAB Singapore is using this service today. The possibility to sign electronically on delivery is rather a criterion to evaluate for the future. Electronic signatures are not used today, but ASSAB Pacific's management believed it would be interesting to know for future reference.

To summarize, of the eight mentioned criteria for forwarding agent selection, the most important criteria were geographical coverage and historical performance. These criteria were therefore decided to be paid most attention when selecting forwarding agents for the RFQ process. The two complementing criteria, electronic signature and cash on delivery, also had to be investigated since ASSAB Pacific's management believed that these criteria can be beneficial when distinguishing forwarders from each other. The financial stability was also of interest to make sure that the selected forwarder would be able to perform deliveries in the long term. The forwarders' IT systems are also an important aspect since this information enable to separate the different forwarders to each other. Only two criteria were delimited from further investigation, environmental considerations and tracking systems, since these criteria are not important from ASSAB Singapore's perspective.

- *Which forwarding agents live up to the criteria set by ASSAB Pacific?*

In order to find suitable forwarding agents a broad scanning of the market was performed. The scanning resulted in 21 different forwarders who are operating in Singapore, see Table 13. Each of these forwarders was contacted in order to retrieve more information. Table 13 also presents whether it was possible to reach the forwarders or not as well as if they were not able to perform the service required.

Table 13. Forwarding agents operating in Singapore

FORWARDING AGENT	STATUS
D8 Delivery	No answer
OCS	No answer
Xdel	Faulty contact details posted online
Speedpost	Answered, cannot perform the service required
Idespach	No answer
A'star Express	Answered
Roadmaster courier	Answered, cannot perform the service required
Network courier	Answered
TNT	Answered, only for customers with an international account
DHL	Answered, only for customers with an international account
UPS	Answered, only for customers with an international account
FedEx	Answered, only for customers with an international account
Regent	Answered, cannot perform steel deliveries
Awesome	Answered, cannot perform the service required
Menlo Worldwide Asia Pacific	Answered, do not deliver within Singapore
Everfast	Answered
NYK logistics	Answered
CEVA logistics	Answered
KATCO logistics	Answered, do not deliver within Singapore
Best Global	No answer
Inscamion transport	Faulty contact details posted

Four of the possible forwarders, D8 Delivery, OCS, Idespach and Best Global could not be reached. After several phone calls and emails without any response these four forwarders were excluded from the study. The forwarders Xdel and Inscamion transport had stated wrong contact details on their websites why these forwarders also were directly excluded from the study. If the company is not able to provide the correct contact information, it is assumed that the company is not serious enough to cooperate with. The forwarders Speedpost, Roadmaster courier, Regent and Awesome logistics were also contacted. These forwarding agents informed that they only deliver small parcels, why they would not be able to perform steel deliveries. Hence, these four forwarders were excluded from the study.

The six global forwarding agents contacted: TNT, DHL, UPS, FedEx, Menlo Worldwide and KATCO Logistics gave a unified response. They do not perform deliveries within Singapore for customers that do not have an international account. Since ASSAB Singapore does not have an international account with neither of these forwarding agents, all six were excluded from the RFQ process.



Five of the companies that were contacted were able to perform ASSAB Singapore's steel deliveries and they were also willing to give a price quote. These companies were A'star Express, Network courier, Everfast, NYK Logistics and CEVA Logistics. These forwarders were given complementing questions in order to make sure that they live up to ASSAB Singapore's expectations. They were evaluated according to the criteria stated under previous research question and the result is presented in Table 14 below.

Table 14. Possible forwarding agents for ASSAB Singapore's deliveries (\*Cash on delivery)

FORWARDER	REFERENCES	COD*	ELECTRONIC SIGNATURE	CREDIT CHECK	SAP ENABLE	GEOGRAPHICAL COVERAGE
A'star Express	Yes, available	Yes	No	Yes	No	All addresses in Singapore
Network Courier	Yes, available	Yes	No	Yes	No	All addresses in Singapore
Everfast	Yes, available	Yes	Yes	Yes	No	All addresses in Singapore
NYK Logistics	Yes, available	Yes	No	Yes	Yes	All addresses in Singapore
CEVA Logistics	Yes, available	Yes	No	Yes	No	All addresses in Singapore

As Table 14 illustrates, Everfast is distinguished from the other forwarders since they can offer electronic signature at delivery. NYK Logistics is the only forwarding agent that has an IT system which is SAP enable. The other three forwarding agents, A'star Express, Network courier and CEVA Logistics have the same prerequisites regarding the criteria set by ASSAB Pacific.

- *To which forwarding agents will the RFQ be sent?*

When deciding to which forwarding agents that the RFQ would be sent, the prioritized criteria described in earlier paragraphs were used. Since the most important criteria are geographical coverage and historical performance, they were paid most attention. As presented in Table 14, the five forwarders that are able to perform the deliveries do deliver to all addresses around Singapore. Therefore, the criteria geographical coverage cannot be used when distinguish the forwarders from each other. Regarding historical performance, the forwarders were asked to give at least one reference of their current customers. The references were contacted via email where questions about the forwarding agents were posed. Out of the five references only Everfast's reference answered the email. They stated that Everfast's services are good and efficient. Despite several tries to get in contact with the other forwarders' references, no answers were received. It is believed that they did not see any self-interest in the enquiry why they chose not to answer. Since we only got one answer, this criterion has been decided to be overlooked. It would not be fair to take this criterion into consideration when it is only depending on the commitment of the forwarders' customers.

The criteria cash on delivery and electronic signature were also investigated. Table 14 illustrates that all five forwarders were able to take care of cash on delivery when delivering goods to the customers. Concerning electronic signature, it is only Everfast that can offer this service why Everfast can be distinguished from the other forwarders.

Regarding the financial stability, a check on these five forwarders was performed. Unfortunately it was not possible to receive any economical history of the forwarders. Instead, information about the forwarders capital structure was received, i.e. the ownership as well as the date of establishment. The documents also confirmed that all forwarders actually are in the transport business which is seen as an extra guarantee before starting collaboration with any of the forwarders. Concerning the establishment of the forwarders, it was found that A'star Express is a very new company on the market. They were established in 2009 why their experience was questioned. Since no references gave information about their historical performance and since the company had just started, A'star Express was regarded as unsuitable for ASSAB Singapore's deliveries. A'star Express was excluded from the study due to the risk that an inexperienced forwarder yields.

At last, a question whether the forwarders' IT systems are compatible with ASSAB Singapore's SAP system was posed. It was found that NYK Logistics as the only forwarder can offer EDI transmission, see Table 14. This is very beneficial since it will enable efficient data transfer between the forwarder and ASSAB Singapore. Hence, NYK Logistics could be positively distinguished from the other forwarders.

Thereby two forwarders had been distinguished and were therefore included in the RFQ process; Everfast and NYK Logistics. Since A'star Express was excluded, two forwarders remain; Network Courier and CEVA Logistics. As illustrated in Table 14 these two forwarding agents have the same prerequisites. When being in contact with these forwarders, CEVA Logistics gave a more professional impression and they also seemed more interested in this task than Network Courier. Due to CEVA Logistic's professionalism and interest, it was decided to include this forwarder in the RFQ process. Hence, the three forwarding agents, Everfast, NYK Logistics and CEVA Logistics, were selected.

- *For how long period of time should the contract run?*

In cooperation with ASSAB Pacific's management, it was decided that the future contract should run for two years. If a shorter time frame would be chosen, it was agreed that the forwarder would not be given a chance to get in to the business. It was also agreed that a longer time frame would involve too much risk for ASSAB Singapore since it is impossible to know the result on forehand. A time frame of two years with start 01/08/2010 therefore seemed reasonable.

#### 6.4 EVALUATION OF FORWARDERS' QUOTES

In this section, the quotes from the forwarding agents are presented. The quotes have been received as quotations on the Request for Quotation that was sent to three forwarding agents; Everfast, CEVA Logistics and NYK Logistics. The research questions concerning the forwarders' quotes, stated in the task specification, will here be answered.

- *What are the base prices for designated orders in the forwarding agents' quotes?*

The base prices quoted by the forwarding agents are stated in Table 15. Everfast has placed the lowest quotes for all three scenarios in comparison to the other two forwarding agents. When comparing CEVA Logistics and NYK Logistics, CEVA Logistics has placed the lower quote when all weights are included, Scenario III, whereas NYK Logistics is more affordable when concerning Scenario I and Scenario II. NYK Logistics makes no difference in price when promising delivery before 12:00 or before 18:00 while CEVA Logistics is not able to offer the service of delivering before 12:00.

Table 15. Forwarding agents' quotes

	SCENARIO I		SCENARIO II		SCENARIO III	
	12:00	18:00	12:00	18:00	12:00	18:00
Everfast	405 688	373 660	571 568	526 780	729 843	674 360
CEVA Logistics	-	540 478	-	663 357	-	765 387
NYK Logistics	435 958	435 958	660 944	660 944	1 038 902	1 038 902

- *What is the price addition concerning cost fluctuations in fuel?*

None of the forwarding agents attached any additional cost keys to their base price quotation.

- *What is the price addition concerning fluctuations in number of designated orders?*

Since no additional cost keys were attached there were no additional prices to be calculated. Hence, the base prices were the only comparable prices.

- *What are the variations in price among the forwarding agents' quotes?*

As earlier stated Everfast placed the most affordable price quote for each scenario. It was also the only company that had placed different quotes for the two lead time demands. Everfast's quote was SGD 30 270 lower than NYK Logistics' for Scenario I with transports under 30 kilograms and deliveries before 12:00 the same day. The largest difference between NYK Logistics and Everfast, SGD 364 542, is for Scenario III with deliveries before 18:00 the same day. Hence the difference between Everfast and NYK Logistics quotes varies between seven and 54 percent.

- *What is the current total transportation cost for designated orders?*
- *What is the total transportation cost when complementing current transportation mode with forwarding agents?*
- *What is the difference in total transportation cost between the current transportation mode and a transportation mode complemented by forwarding agents for designated orders?*

Table 16 illustrates the forwarding agents' price quotes and ASSAB Singapore's current total transportation cost. When comparing Everfast's, CEVA Logistics' and NYK Logistics' price quotes to the current cost of transportation, the current cost is much lower than the price quotes. The most affordable price quote with deliveries of goods less than 30 kilograms is already approximately SGD 100 000 more expensive than all the transports, no matter weight, with the current transportation mode. If accepting Everfast's price quote for all transports and delivery before 18:00 the total transportation cost would increase with approximately 150 percent. These large differences make it irrelevant to calculate the answers to the three research questions stated above.

Table 16. Forwarding agents' quotes in comparison to ASSAB Singapore's current total transportation cost

	SCENARIO I		SCENARIO II		SCENARIO III	
	<i>12:00</i>	<i>18:00</i>	<i>12:00</i>	<i>18:00</i>	<i>12:00</i>	<i>18:00</i>
Everfast	405 688	373 660	571 568	526 780	729 843	674 360
CEVA Logistics	-	540 478	-	663 357	-	765 387
NYK Logistics	435 958	435 958	660 944	660 944	1 038 902	1 038 902
CURRENT SITUATION						271 450

## 7 ANALYSIS

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*In this chapter an analysis regarding the empirical results of the study is presented. The analysis includes discussions concerning the total transportation cost, the selection of data and forwarding agents, the quotes from forwarding agents as well as issues concerning the Singaporean market. At last, risks with changing as well as keeping the distribution structure are elaborated to give a better understanding of how the system could be affected.*

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### 7.1 DESCRIPTION OF THE CURRENT SITUATION: TOTAL TRANSPORTATION COST

In this study, when analyzing ASSAB Singapore's current transportation cost, a transport supplier's perspective was used to enable a fair comparison to the forwarders' quotes. With consideration to Rushton et al.'s (2006) and Pewe et al.'s (2002) total transportation cost models, a transportation cost model suiting ASSAB Singapore's needs was developed, see Figure 20. The total transportation cost model includes three elements; fixed, variable and overhead costs. In Section 6.1 these three cost elements were determined with data retrieved from ASSAB Singapore's SAP system for 2009.

As presented in Table 5, the fixed, variable and overhead costs compose 72, twelve and 16 percent respectively of the total transportation cost. When comparing this result with Pewe et al.'s (2002) theories, one can see that the variable costs compose a small portion of the total cost compared to other companies. Pewe et al. (2002) state that the fixed cost, where overhead costs are included, usually compose about 65-70 percent whereas the variable costs normally compose about 30-35 percent of the total transportation cost, see Section 3.2.1 and Section 3.2.2. A possible reason why the variable costs compose such a small portion of the total cost in ASSAB Singapore's case is that delivery routes are relatively short why the fuel consumption and the need of repairs and maintenance are low. There is further no running vehicle tax in Singapore. Therefore, ASSAB Singapore's variable costs compose a smaller portion of the total transportation cost than Pewe et al. (2002) state.

The fixed cost, which composes the major part of the total transportation cost, is made out of many different cost items. It further includes the largest cost items in the total cost which are the cost of the subcontracted vehicle (42 percent of the fixed costs) and the cost of drivers' salaries (36 percent of the fixed costs), see Diagram 8. Considering variable costs, fuel and repairs and maintenance are the largest cost items, see Diagram 8. This is not very surprising since the usage of the vehicles directly generates these costs. The overhead cost on the other hand is unexpectedly large. The overhead cost items compose such a large amount that they should not be overlooked; it is even more extensive than the variable costs. The dispersion of overhead transportation costs is illustrated in Diagram 8. Rushton et al. (2006) and Andersson (2007) emphasize the importance of the overhead costs when investigating total transportation costs and the result in this investigation is in line with their statements. Andersson (2007) states that several overhead costs can be hidden within the organization why it is important to perform a thorough investigation. Therefore, overhead costs should always be included when analyzing total transportation costs.

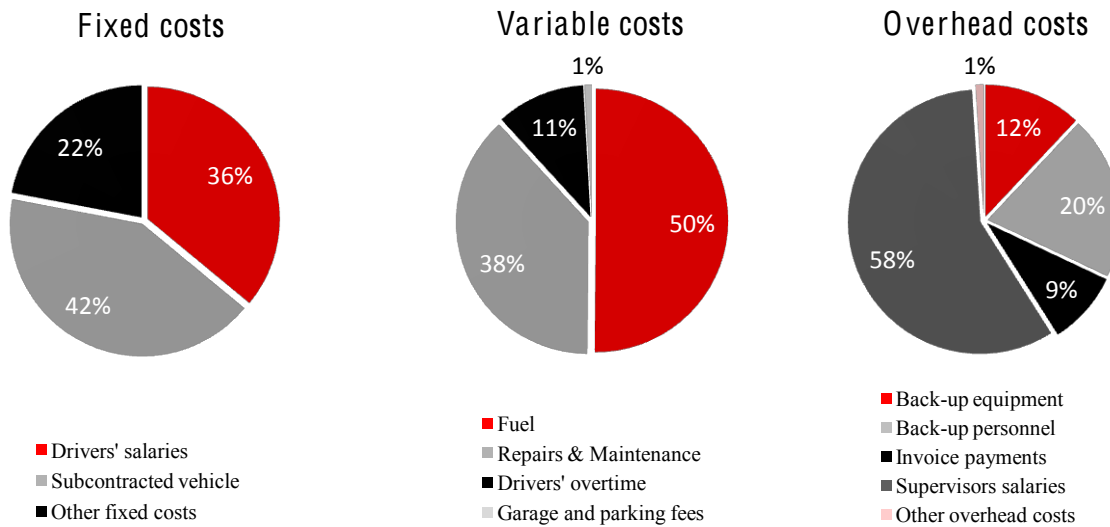


Diagram 8. The dispersion of fixed, variable and overhead transportation costs

When comparing the costs for ASSAB Singapore's own drivers, vehicles and overhead with the cost for the subcontracted vehicle, it was found that the subcontracted vehicle is much more expensive than one of ASSAB Singapore's own drivers and vehicles (equipages). The subcontracted vehicle has a total annual cost of SGD 82 800 while one of ASSAB Singapore's equipages composes a total cost of SGD 37 730 on average. The cost for one equipage is based on the total costs of ASSAB Singapore's four ordinary equipages and the spare equipage. This means that one of ASSAB Singapore's own equipages only compose about 45 percent of the cost for the subcontracted vehicle. This indicates that ASSAB Singapore potentially could reduce the total transportation cost if changing the current subcontractor to either a forwarder or a new company owned equipage; disregarding financial risks of owning the vehicles and increasing tied up capital.

## 7.2 DESCRIPTION OF THE CURRENT SITUATION: DISTRIBUTION STRUCTURE

For the description of the current situation, figures from January to December 2009 were retrieved from ASSAB Singapore's business management software, SAP. 2009 was a financially unstable year in most parts of the world including Singapore. Due to this instability, an investigation of the number of deliveries for an upcoming year might be different from the number obtained in this study. The influence of the number of deliveries on the comparison between the quotes is therefore a part of the sensitivity analysis in the form of a break-even, see Section 8.5.

During the collection of data it was found that ASSAB Singapore had 332 customers during 2009. In Section 2.2.1 it is stated that the company has 500 to 600 active customers. This can be perceived as contradictive but it must be kept in mind that the company defines active customers as customers that have placed an order during the last two years. Therefore no conclusions can be drawn from this retrieved figure whether the company's estimation is correct or not.

## 7.3 REQUEST FOR QUOTATION

When identifying potential forwarding agents for the RFQ process, three different types of forwarders were contacted: courier service forwarders, local forwarders and global forwarders. All forwarders that

were contacted are presented in Table 13. The forwarders were contacted after setting the weight limits for the designated orders why it could be investigated whether they could deliver the weights and whether they were active on the Singaporean market or not.

The forwarders in the courier service segment were not able to perform the service required in this investigation. They stated that they had problems handling the weights of steel that ASSAB Singapore delivers to its customers. Most of them were able to only transport smaller deliveries, i.e. the ones below 30 kilograms or only even smaller packages. Since there were other forwarders on the market that were able to perform all deliveries, the courier service forwarders were excluded from further investigation.

The global forwarders that were contacted all stated that they do not perform deliveries within Singapore for customers that do not have an international account. Hence, these forwarders needed no further investigation since ASSAB Singapore does not have an international account. The forwarders were asked why they do not perform domestic deliveries within Singapore and most of them stated that they simply cannot compete with price on such a small market why they have chosen to focus on international deliveries.

The third and last forwarder segment that was investigated was local forwarders. These forwarders perform all kinds of deliveries within Singapore why they suited ASSAB Singapore's needs the most. They could offer execution of all three scenarios why it was chosen to move further with investigations of this particular type of forwarders.

Since these three types of forwarders are specialized on different kinds of transports a comprehensive view could be achieved. It can therefore be stated that no important part of the forwarding market in Singapore was overlooked. A decisive factor when selecting type of forwarder has been the weight limits that have been set up. Lower limits would have favored courier services but since the levels had to be set in such a way that it would lead to a major decrease in own deliveries, the local forwarders have been a definitive choice.

#### 7.4 EVALUATION OF FORWARDING AGENTS' QUOTES

When comparing ASSAB Singapore's current total transportation cost with the price quotes received from forwarding agents, it can be assured that the current distribution structure is significantly more affordable than the prices offered by the forwarders, see Table 16. The best price quote is given from Everfast. They can offer a total annual price of SGD 674 360 for all deliveries, compared to ASSAB Singapore's current cost of SGD 271 450. A switch would thereby lead to an increase with almost 150 percent from the original cost. Since the gap between the most affordable quote for Scenario III and the current situation is this big and the fact that the other scenarios are no better, the future analysis will be focused on Scenario III. The quotes from CEVA Logistics and NYK Logistics are even more expensive than Everfast's and the differences between the companies' quotes are notable. A possible reason why the quotes vary is because the forwarders are not used to handle deliveries such as ASSAB Singapore's. It is believed that the wide distribution of weights makes it hard for the forwarders to give accurate price quotes. This is also believed to be a contributing factor to the difference between the scenarios of the forwarders' quotes. However, the result with the forwarders' quotes being much more expensive than the current situation is surprising. Therefore, discussions about possible reasons to this will follow.

Since the local forwarding agents selected in this study both are able to deliver small parcels as well as larger deliveries, their area of specialization can be questioned. For example, Uddeholm KK in Japan is using different forwarders for different kinds of deliveries. They use four different forwarders specialized on different transport weights. The fact that the three forwarders were asked to give price quotes for all deliveries might have affected the result. The price quotes given for the three scenarios, are independent of the weight of each individual delivery. This means that deliveries of different weights, but within the same scenario, generate the same cost for ASSAB Singapore. This might have affected the result making the quotes more expensive than the current total transportation cost. Therefore, it might have been better to contact different forwarders for the different scenarios. For the deliveries included in Scenario I, courier services specialized in small deliveries may have been a better choice. Their specialization and different pricing for small deliveries could have been beneficial for this scenario. For larger deliveries, the local forwarders are regarded as the best option since these deliveries are in line with their normal businesses. Even though the RFQ was sent exclusively to local forwarders, it can be ascertained that a different approach would not have affected the result in this study. The cost gap between the quotes given and ASSAB Singapore's current transportation cost is too big to achieve another outcome of the study.

The price quotes given from the forwarders have not been further negotiated. When being in contact with the forwarders, they have given the impression that the prices are negotiable. This means that the total price given from the forwarders can be reduced and match ASSAB Singapore's total transportation cost in a better way. However, the fact that the least expensive quote yields a total cost increase of 150 percent gives that it is not likely that the forwarders can offer a negotiated price equal or lower than ASSAB Singapore's current total transportation cost.

In the following section, the Singaporean market's influence on the result and thereby the study's level of generalization will be further discussed.

#### 7.4.1 THE SINGAPOREAN MARKET

As stated in the directives, see Section 1.3.1, the Singaporean market was chosen for this study since its coverage is comparative to customers located in one or several neighboring production zones on other markets. The largest difference is that deliveries have to be made to the production zones on the other markets before delivery to the different customers. This is not the case on the Singaporean market. The Singaporean market was also chosen due to its proximity to the parent company, ASSAB Pacific, which is the company requesting the investigation. The choice of market is believed to play an important role in the achieved result since every market and country has its own particularities and laws. Particularities that distinguish Singapore from many western markets are for example its low labor cost, affordable vehicles and low diesel price. What distinguish it from several eastern markets is that traffic jams are seldom present and that the infrastructure is highly developed. Singapore's size on the other hand, is a factor that makes it stand out in comparison to both western and eastern countries. But since the study was decided to be performed on the Singaporean market these particularities are prerequisites and can therefore not be seen as sources of error. A second study with the same prerequisite, the Singaporean market, would most likely achieve the same cost distribution as this study. Still the result might appear surprising. A relevant reflection is that a forwarding agent should be able to match or even offer lower prices to their services than a producing company could achieve on its own. This since forwarding is the forwarding agents main activity whereas it is a side job for the producing company.



As discussed in Section 3.1.2, Oskarsson et al. (2006) argue that companies buying transportation services have three major requirements that the forwarders have to meet; low costs, high level of service and short lead time. The demand for services at a low cost implies that the buying companies are not willing to increase their costs as a result of the collaboration, why the forwarders have to place their prices at a lower rate than the companies can attain on their own. Oskarsson et al. (2006) mean that the forwarders can offer the requested low rates if keeping a high filling degree in the trucks. They need to work with large volumes that many producing companies do not reach on their own. The forwarders on the other hand can take advantage of the volumes of several customers and consolidate to attain the volumes necessary. Consolidations decrease the number of transports and thereby the transportation costs. (Oskarsson et al., 2006)

When considering Singapore, the distance between the supplier and the customer is always relatively short since the island on which the country is situated is only 700 square meters. These short distances affect the need of consolidation. Further, the short delivery lead time of one day from picking up goods to reaching the customer, also affects the need of consolidation when considering such a small market as the Singaporean. For the forwarders, consolidation generates extra working moments but usually the total lead time can be decreased due to a higher delivery frequency (Oskarsson et al., 2006). With the service demand of a delivery lead time no more than one day and the small distances, the necessity of consolidation has lost its importance. This is one explanation to why the forwarders cannot match ASSAB Singapore's current transportation cost. Another reason is that ASSAB Singapore has a steady flow of material going between its customers and the distribution center, on average 59 deliveries per day (approximately 500 kilograms per vehicle) why their filling rate is expected to be high and hard to improve significantly. The two more expensive forwarding agents, CEVA Logistics and NYK Logistics have also given their prices based on the number of deliveries and not only on the weight delivered. Since they have a high initial cost, their prices are higher than the current total cost and Everfast's quote. In accordance to this discussion it is believed that it is foremost the length of the delivery lead time and the low utilization of consolidation that makes it less profitable to use forwarding agents in ASSAB Singapore's case.

#### 7.4.2 RISKS WITH CHANGES IN DISTRIBUTION STRUCTURE

A possible change in the distribution structure involves several risks. These risks must be evaluated before taking a transportation decision. First of all, there is a risk that the current service level will be affected by a change. Even though the forwarders can perform deliveries with the same reliability within the same delivery lead time as ASSAB Singapore, it is not certain that the flexibility will remain the same. The current distribution structure is regarded as flexible since ASSAB Singapore has access to five ordinary equipages and one back-up equipage. The back-up equipage is used for urgent deliveries to important customers when needed as well as for extra large and heavy deliveries. Hence, the current structure is flexible in the sense of delivery lead time and weights. With a change in the distribution structure, this service would probably be offered, but to a higher price. Due to the question of price this could affect the flexibility. This issue must be taken into consideration before changing the distribution structure otherwise customers' satisfaction may decrease.

Another issue when changing the distribution structure is the overtime compensation. In the current situation the compensation to ASSAB Singapore's drivers is small in the context. This means that it is not a big issue for the company if the drivers have to work overtime once in a while. If outsourcing the

transports to a forwarder, overtime will not be as affordable. Forwarders charges for overtime is significantly higher than what is paid to ASSAB Singapore's own drivers', why this issue must be considered before changing the distribution structure.

There are also risks involved with keeping the current situation. There are risks with owning vehicles since they can break down or be involved in an accident which could be expensive despite insurances. These kinds of circumstances could also make the vehicle unusable during reparations. There are also risks of employing personnel. If a driver becomes sick or for some other reason does not show up for work, the responsibility lays with ASSAB Singapore to find a back-up in order to deliver the customers goods. The current distribution structure heavily depends on the knowledge and routines possessed by the company drivers. If any of them decides to resign or retire these important possessions might be lost something that would weaken the current structure. At last, forwarding is not a part of ASSAB Singapore's core business neither is it one of the company's core competences. Therefore performing deliveries might take away the focus from the areas that create value to the customers and margin for the company.

## 8 SENSITIVITY ANALYSIS

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*In this chapter the sensitivity of the result is determined in order to judge the credibility of the result. It therefore includes analyses of how the final result has been affected by estimations and the data being used throughout the study. The sensitivity analysis also includes an analysis of the break-even, in number of deliveries, concerning each quote given from the forwarding agents.*

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### 8.1 INTRODUCTION

According to Oskarsson et al. (2006) most calculations contain different simplifications and estimations. These estimations are in many cases necessary to make in order to find a result. At the same time, this sometimes leads to errors in the calculations. Occasionally the errors are so minor that they do not affect the result, but other times the effect is crucial. Oskarsson et al. (2006) state that it is important to understand that the calculations are not fully reliable and that it is important to perform an evaluation of how insecure they are and how sensitive the result is. Therefore, a sensitivity analysis should be performed which illustrates how the result is affected by a change in estimations and in used data. (Oskarsson et al., 2006)

Some of the cost items in this study are based on estimations since exact information was impossible to retrieve. These estimations might have affected the result why they will be further analyzed. Estimations were made for the overhead costs when applying the ABC theory. This sensitivity analysis will therefore elaborate overhead costs that might have affected the result of the study. The fixed and variable costs do not involve any estimations, why these cost items are seen as trustworthy. Even though the fixed and variable costs do not involve any estimations, costs might change due to different reasons why this will be investigated in the sensitivity analysis. At last, the sensitivity analysis also includes an analysis of the break-even concerning each quote given from the forwarding agents. The break-even analysis is based on the number of deliveries performed during one year.

### 8.2 FIXED AND VARIABLE TRANSPORTATION COSTS

The calculations concerning fixed and variable transportation costs in this study are based on information retrieved from ASSAB Singapore's business management software, SAP. This information is therefore regarded as accurate why there is no reason to question the result of fixed and variable transportation costs. When the fixed cost was calculated, salaries for four own drivers were included. In December 2009 one of the drivers left ASSAB Singapore and a replacement has not yet been found. This brings that the total fixed cost would be lower if calculated for 2010. Since lower current costs would increase the gap between the total cost and the forwarders' quotes, no sensitivity analysis is necessary for this parameter.

In January 2009, ASSAB Singapore's trucks had been fully depreciated for two years and the three vans had its last depreciation. The total vehicle depreciation cost was set equal to zero since this will be the case the following years. But in the long term, ASSAB Singapore has to buy new vehicles why it is interesting to make a sensitivity analysis of how this would affect the final result. This analysis is presented in the following section.

#### 8.2.1 VEHICLE DEPRECIATION

The sensitivity analysis of vehicle depreciation is based on a worst case scenario, i.e. if all company owned vehicles are renewed at the same time.

In Table 17 purchasing prices as well as the yearly depreciation cost for each vehicle are presented. The calculations are based on purchasing prices for the vehicles currently owned by ASSAB Singapore. It appears likely that ASSAB Singapore will pay approximately the same price when buying vehicles in the near future. Since ASSAB Singapore uses a depreciation time equal to five year for vehicles, this analysis is based on the same time frame.

Table 17. Potential purchasing prices and annual depreciation cost if buying five new vehicles (\* Multiplied by 91 percent according to earlier calculations)

OWN VEHICLES	PRICE [SGD]	DEPRECIATION [SGD]
Truck (ten feet)	45 835	9 167
Van 1	35 388	7 078
Van 2	35 388	7 078
Van 3	35 388	7 078
Back-up truck (14 feet)	56 700	11 340*
<b>TOTAL COST OF VEHICLES</b>	<b>208 698</b>	<b>41 740</b>

With a depreciation time of five years, the total yearly depreciation cost is SGD 41 740. The result when adding this cost to the current total transportation cost is presented in Table 18.

Table 18. ASSAB Singapore's current total transportation compared to the cost with vehicle depreciation added

	CURRENT SITUATION [SGD]	WITH DEPRECIATION [SGD]
Total fixed transportation costs	195 906	237 645
Total variable transportation costs	32 344	32 344
Total transportation overhead costs	43 201	43 201
<b>TOTAL TRANSPORTATION COSTS</b>	<b>271 450</b>	<b>313 190</b>

In the worst case scenario, when adding depreciation cost for five new vehicles, ASSAB Singapore's total transportation cost would be SGD 313 190. When comparing the result with the forwarders' quotes, ASSAB Singapore's total transportation cost is still only 46 percent of the lowest quote (Everfast, Scenario III). The conclusion of this analysis is that the forwarders cannot match ASSAB Singapore's total transportation cost, even though ASSAB Singapore would buy five new vehicles. Hence, the lack of depreciation of vehicles has not affected the result in this study.

Another factor concerning the depreciation is the length of the depreciation time. As stated in Section 3.2.1 Rushton et al. (2006) has found that companies usually expect their vehicles to run for five to eight years which makes five years a reasonable depreciation time. If it would have been longer the cost of depreciation per year would have been even lower. Hence, the depreciation time of five years is realistic.

### 8.3 OVERHEAD TRANSPORTATION COSTS

When calculating the overhead costs, estimations regarding the time spent on different activities were made by the employees involved. These estimations involve uncertainties that might affect the result why relevant overhead costs will be analyzed in this sensitivity analysis.

Overhead costs included in this study are costs concerning back-up equipments, back-up personnel, salary payments, invoice payments, supervising and buildings. In order to find the most critical sources of error concerning the overhead costs, a risk matrix was used. Each overhead cost has been analyzed according to the insecurity of the estimation and the possible consequence if the estimation would be wrong, see Figure 34.

Insecurity in collected data

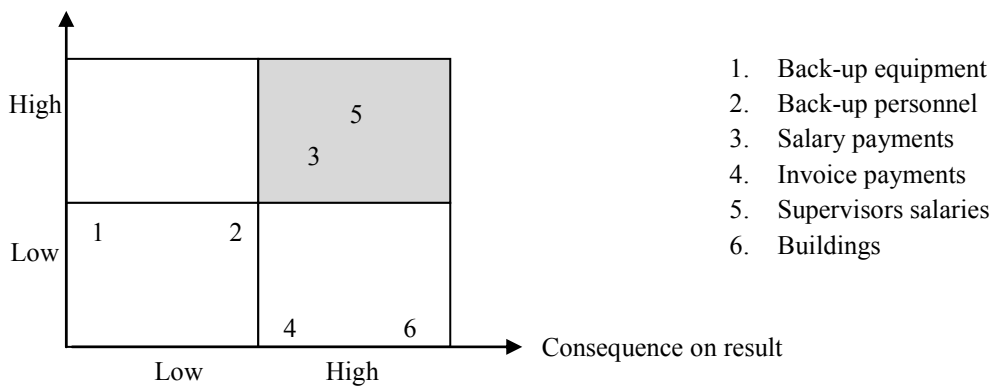


Figure 34. Risk matrix (modified Oskarsson et al., 2006)

The calculations of costs of back-up equipments and back-up personnel are considered to be accurate since the back-up driver and the Supervisor could thoroughly explain how often the back-up truck is used and how much time the back-up driver spend on deliveries. These two overhead costs will therefore not be analyzed further since the insecurities and the consequences of the risks are considered low. The cost of invoice payments is also seen as accurate since the cost is based on the number of transport related invoices compared to the total number of invoices during 2009. This information was retrieved from SAP and there are no reasons to question this result. Hence, the insecurity is considered low and it will therefore not be further elaborated even though the consequence if the estimation would be wrong is considered greater. Regarding cost of buildings, i.e. cost of the area used by the employees involved in this study, precise information concerning the land surface and the building surface were available. Even though the consequence of the risk is high, it will not be analyzed further since the insecurity is considered very low.

In conclusion, there are two overhead costs, cost of salary payments and cost of supervisors, that involves more uncertainties than the other overhead costs. Both insecurity and the consequence of the risk are considered high and they will therefore be further analyzed in this sensitivity analysis.

### 8.3.1 COST OF SALARY PAYMENTS

When calculating the cost of salary payments an estimation of the Salary Administrator's time spent on this activity was performed. The Financial Controller estimated that one day per month is spent on this activity. This sensitivity analysis will investigate the influence of the result if the Salary Administrator actually spends more time on this activity.

In Table 19, the change in cost is presented when varying the Salary Administrator's time spent on salary payments. First, the time spent was doubled to two days per month and thereafter the cost was calculated if spending seven days per month on salary administration.

Table 19. The overhead transportation cost with variation in time spent on salary payments

OVERHEAD TRANSPORTATION COSTS	1 DAY [SGD]	2 DAYS [SGD]	7 DAYS [SGD]
Back-up equipment	5 192	5 192	5 192
Back-up personnel salary	8 551	8 551	8 551
Salary payments	217	434	1 520
Invoice payments	4 031	4 031	4 031
Supervisors salaries	24 978	24 978	24 978
Building	233	233	233
<b>TOTAL OVERHEAD COST</b>	<b>43 201</b>	<b>43 419</b>	<b>44 505</b>

As Table 19 illustrates, the change in total overhead cost is very small when varying the time spent on salary payments. This indicates that ASSAB Singapore's total transportation cost will not change significantly. Even though the estimation of time spent might involve a smaller error, this does not affect the outcome of this study. The current total transportation cost would still be the least expensive transportation alternative for ASSAB Singapore.

### 8.3.2 COST OF SUPERVISORS' SALARIES

When calculating the cost of supervising, the supervisors were asked to estimate the time they spend on coordination of the transports every day. The Supervisor of steel deliveries stated that he spends eleven percent of his working time on coordinating steel deliveries, whereas the Supervisor for heat treatment deliveries stated that he spends 60 percent on supervising heat treatment deliveries. The variation between these two statements can be surprising at first, but the heat treatment Supervisor explained that it takes a lot more time coordinating heat treatment deliveries since it includes three vehicles and six daily delivery routes. The steel deliveries on the other hand only include one vehicle and two daily routes. Therefore, the heat treatment Supervisor spends significantly more time on supervising. Since the estimation is not completely trustworthy an investigation of the change in overhead cost will be performed given that the Supervisor of steel deliveries spends more time on supervising than estimated. An appropriate comparison in this investigation is to compare the current cost of supervising with the cost if both supervisors spending 60 percent on coordination. The result is presented in Table 20.

Table 20. The overhead transportation cost of current state and the scenario when both supervisors spend 60 percent on coordination

OVERHEAD TRANSPORTATION COSTS	CURRENT SITUATION (11% AND 60%) [SGD]	BOTH 60% [SGD]
Back-up equipment	5 192	5 192
Back-up personnel salary	8 551	8 551
Salary payments	217	217
Invoice payments	4 031	4 031
Supervisors salaries	24 978	43 382
Building	233	233
<b>TOTAL OVERHEAD COST</b>	<b>43 201</b>	<b>61 606</b>

As illustrated in Table 20 the total overhead transportation cost increases by 43 percent if both supervisors spend 60 percent of their working time on coordination. This is a rather big change in overhead cost, but according to Table 21, the total transportation cost just increase by seven percent. This means that the current transportation cost would still be less expensive than all the forwarders' quotes independent of scenario and delivery lead time. Hence, the supervisors' estimations regarding the time spent on coordinating the deliveries have no affect on the outcome of this study.

Table 21. Total transportation cost of current state compared to the scenario when both supervisors spend 60 percent on coordination

	CURRENT SITUATION (11% AND 60%) [SGD]	BOTH 60% [SGD]
Total fixed transportation costs	195 906	195 906
Total variable transportation costs	32 344	32 344
Total transportation overhead costs	43 201	61 606
<b>TOTAL TRANSPORTATION COSTS</b>	<b>271 450</b>	<b>289 856</b>

#### 8.4 COMPILATION OF SENSITIVITY FACTORS

The worst case scenarios for the three cost items, *vehicle depreciation*, *salary payments* and *supervisors*, analyzed in the sensitivity analysis, do not separately affect the result of the study. Table 22 illustrates the total of the worst case scenarios for the three analyzed cost items together with the unchanged fixed, variable and overhead costs. The worst case total transportation cost is equal to SGD 332 898; still lower than the most affordable quote for Scenario I, deliveries of goods weighing less than 30 kilograms. From this it can be concluded that the result is insensitive to the purchase of new vehicles as well as the estimations made for the overhead transportation cost in the study.

Table 22. Compilation of sensitivity factors, worst case scenario

WORST CASE SCENARIO	[SGD]
Unchanged fixed costs	195 906
Vehicle depreciation	41 740
Unchanged variable costs	32 344
Unchanged overhead costs	18 006
Salary payments	1 520
Supervisors	43 382
<b>TOTAL TRANSPORTATION COST</b>	<b>332 898</b>

### 8.5 BREAK-EVEN

The total cost calculated from forwarding agents' price quotes are all dependent on the number of deliveries that are to be performed. The difference is to what extent the quotes vary with changes in the number of deliveries. Since none of the forwarding agents have attached an additional price key for shifts in the number of deliveries it is concluded that their prices would remain the same even if the number of deliveries would decrease.

During 2009 ASSAB Singapore performed 15 347 deliveries. The total costs of forwarders' quotes with 15 347 deliveries have already been illustrated in Table 16. Table 23 includes break-even for the three forwarders' quotes respectively when considering the number of deliveries, i.e. at what number of deliveries the forwarders' quotes would be lower than the current cost of transportation. CEVA Logistics' quotation meets break-even at 5 088 deliveries annually. Hence, only a third of the deliveries performed during 2009. Both Everfast and NYK Logistics reach break-even at approximately 3 700 deliveries per year. This means that the break-even is lower than one third of the annual deliveries 2009 for all of the forwarders. The probability that the annual deliveries would decrease to only a third within the next couple of years is low. It is thereby possible to say that none of the forwarders' quotes is probable to become lower than the cost of the current situation when considering a decrease in the number of annual deliveries.

Table 23. Break-even due to number of deliveries affecting the three forwarding agents' quotes

	NUMBER OF DELIVERIES [NBR]	SCENARIO III, 18:00 [SGD]
Everfast	3 697	271 430
CEVA Logistics	5 088	271 416
NYK Logistics	3 718	271 388
<b>CURRENT SITUATION</b>	<b>15 347</b>	<b>271 450</b>

No break-even for Scenario I or Scenario II has been made since this would not make a difference to the result. For these two scenarios parts of the current delivery structure would have to be kept which increases the total cost of these quotes when applied.



## 9 CONCLUSIONS AND RECOMMENDATIONS

*In this chapter the main conclusions of the study are presented. An explanation of the fulfillment of the purpose and the results are presented. Thereafter recommendations to ASSAB Singapore as well as to ASSAB Pacific follow. The recommendations towards ASSAB Singapore mainly concern the data results whereas the recommendations towards ASSAB Pacific concern the Asian market with a more general perspective.*

### 9.1 CONCLUSIONS

The purpose of this study was to "... map ASSAB Singapore's current distribution structure and its total transportation cost. Through a Request for Quotation the current situation will be compared to retrieved quotes from forwarding agents.". The current distribution structure has been mapped including the vehicles and routes used as well as the deliveries performed and their individual weights. Furthermore, the total transportation cost has been calculated based on the relevant fixed, variable and overhead costs. At last, the current transportation cost has been compared to the forwarding agents' quotes. The conclusion of this comparison is stated below. From this reasoning it can be concluded that the purpose of this study has been accomplished.

As it has been shown in the empirical result, the current distribution structure is more affordable than the price quotes that have been received from the forwarding agents no matter scenario or delivery lead time, see Table 24. The result has been achieved despite of two major factors. Firstly, a thorough scanning of the whole forwarding market in Singapore has been performed in order to find the most suitable type of forwarder to include in the RFQ process. Secondly, all transportation related costs, fixed, variable as well as overhead, have been included in the current total transportation cost. The sensitivity analysis has further proven that this result is insensitive to both changes in the number of deliveries, increased overhead costs as well as an investment in new company vehicles.

Table 24. Forwarding agents' quotes in comparison to ASSAB Singapore's current total transportation cost

	SCENARIO I		SCENARIO II		SCENARIO III	
	12:00	18:00	12:00	18:00	12:00	18:00
Everfast	405 688	373 660	571 568	526 780	729 843	674 360
CEVA Logistics	-	540 478	-	663 357	-	765 387
NYK Logistics	435 958	435 958	660 944	660 944	1 038 902	1 038 902
CURRENT SITUATION						271 450

It must be kept in mind that cost is not the sole decisive criteria. Although delivery service towards company customers is very important, the dimension of the price difference makes it unnecessary to analyze if the service level would increase with a change. ASSAB Singapore's customers are satisfied as it is today and no demands have been placed on the company to improve its current delivery service.

The large difference in price and the fact that no improvements of delivery service is demanded, changing the current distribution structure to a forwarding agent is not economically defendable on the Singaporean market at present. A change would increase the transportation costs with 150 percent. It can thereby be

concluded that ASSAB Singapore should keep its current distribution structure rather than contract a forwarding agent to avoid a major increase in transportation costs.

## 9.2 RECOMMENDATIONS

This section has been divided into recommendations toward ASSAB Singapore and recommendations toward ASSAB Pacific. According to the companies' different interests, the recommendations have been addressed accordingly. ASSAB Singapore is believed to be more interested in recommendations concerning the data results whereas ASSAB Pacific is assumed to be more interested in recommendations in a broader perspective concerning the Asian market.

### 9.2.1 ASSAB SINGAPORE

According to the results of this study, the use of forwarding agents is not economically defensible for ASSAB Singapore's local deliveries. If changing the distribution structure and thereby involving forwarding agents, the cost will increase significantly. Therefore, ASSAB Singapore is recommended to stay with its current distribution structure which includes own company drivers and vehicles. However, price is not everything. Better service towards the customers might generate more sales in the long term. Hence, the service level must be evaluated in order to satisfy the customers' demands. In this study where the cost gap between the current situation and the scenarios is significant, the service level is not as important as it could be in other cases. But before changing any distribution structure, risks concerning the service concept must be taken into account.

In this study it was also found that ASSAB Singapore has one subcontracted vehicle which generates significantly more costs than ASSAB Singapore's own equipages. A recommendation for ASSAB Singapore is therefore to investigate the possibilities of changing the subcontracted vehicle into a new company owned vehicle and a new driver. While doing such an investigation, parameters such as tied up capital and risks have to be evaluated beside the total cost. For example, when using a subcontracted vehicle ASSAB Singapore does not have to consider risks such as damages of the vehicle or personnel issues.

In the future when making decisions of changes in the distribution structure, the current total transportation costs must be calculated with consideration to fixed, variable and overhead transportation costs. As this study has shown, ASSAB Singapore's current overhead costs are larger than the variable transportation costs, why the overhead costs cannot be overlooked. Service elements such as flexibility, customization, delivery lead time and reliability must be evaluated to assure that the current service level towards the customers will not be affected in a negative way. The service elements flexibility and customization are rather speculative, but they must still be considered since they might be essential for the company's future sales.

### 9.2.2 ASSAB PACIFIC

A recommendation to ASSAB Pacific is that the result of this study should not be seen as a general result on all markets around Asia. The difference between Asian countries such as Japan, China and Singapore are more substantial than the difference between countries in Europe for example Sweden, Germany and Spain. The differences between the countries make it hard to achieve a general result of a study as this one. Therefore, it cannot be concluded that forwarding agents would not be effective on other markets within the group.

It has been found that it is foremost the two factors, delivery lead time and consolidation, that rule if it would be profitable for ASSAB Singapore to use forwarding agents for local deliveries. The short delivery lead time of one day and the low need of further consolidation in Singapore both tell against forwarding agents on the Singaporean market.

When investigating the cost saving potential on other markets, ASSAB Pacific is recommended to use the same procedure as in this study, see Figure 35. The four-step model includes the steps; *Description of the current situation: Total transportation cost*, *Description of the current situation: Distribution structure*, *Request for Quotation* and *Evaluation of forwarders' quotes*.

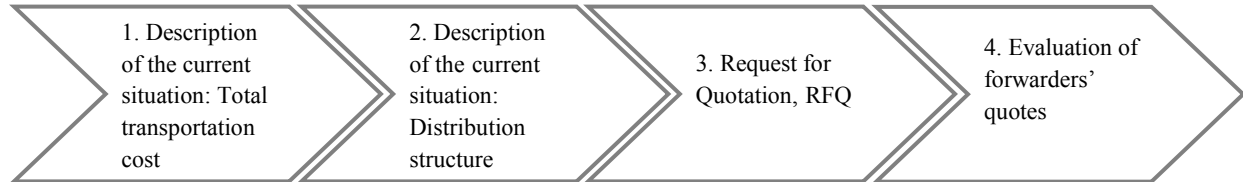


Figure 35. ASSAB Singapore's transport purchasing process (modified Pewe et al. 2002)

The most important thing to remember in the first step is to include all costs related to the distribution, i.e. fixed, variable as well as overhead costs. The second step includes the identification of the current distribution structure, vehicles, delivery weights and customers' localization. Knowing the current situation enables you to write a complete RFQ and not to overlook important information that the potential forwarders are in need of for placing a quote. The third step includes constructing the RFQ and setting up criteria for an ideal forwarder as well as sending out the RFQ:s accordingly. At last, in the fourth step the quotes received from the forwarders should be evaluated according to the current total transportation cost in order to find a suitable forwarder, if any.

Again, a recommendation when evaluating different alternatives, when it comes to transports, is to consider both cost and service. Even though a forwarding agent might be very cost effective the change could affect sales and customer satisfaction in the long term. Hence, risks of changing or keeping the current distribution structure must be evaluated as well as how the level of different service elements will be affected.

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## I. APPENDIX – DELIVERY AND COLLECTION ROUTES

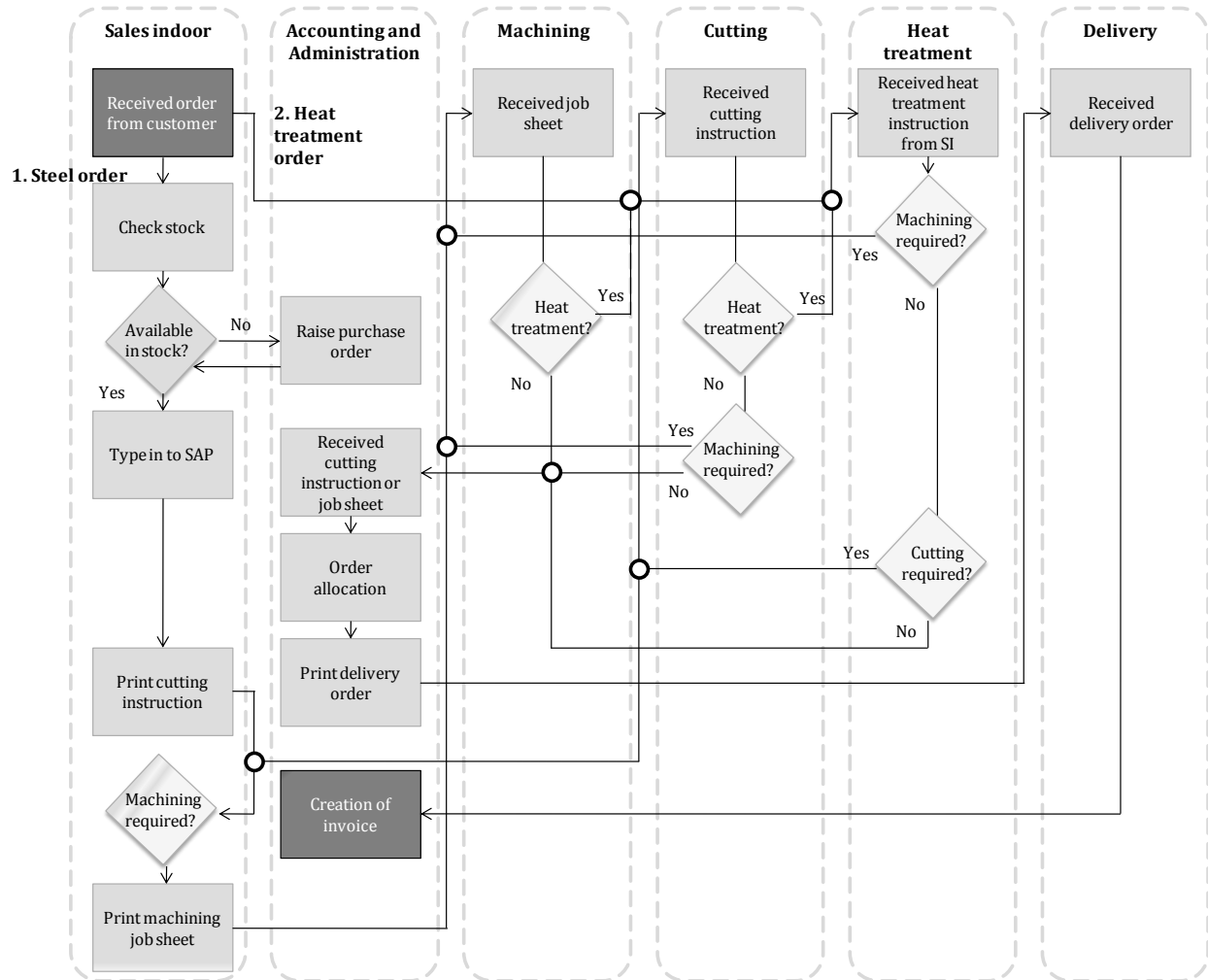
Delivery and collection routes and timing for steel and heat treatment transports (Leng, 2010).

Time Zone	AMK & WDL	Time Zone	Jurong	Time Zone	Town
9:00	ASSAB	9:00	ASSAB	9:00	ASSAB
9:15	Depart	9:15	Depart	9:15	Depart
9:45	WDL	9:30	Post office	10:00	Serangoon North
10:30	Senoko	10:00	Bukit Batok	10:45	Loyang
11:15	Yishun	10:30	Int'l Rd/ Chin Bee	11:15	Changi North
12:00	ASSAB	11:30	Kian Teck/ Joo Koon	12:00	ASSAB
		12:00	ASSAB		
Loading & Unloading		Loading & Unloading		Loading & Unloading	
12:45	ASSAB	12:45	ASSAB	12:45	ASSAB
13:00	Depart	13:00	Depart	13:00	Depart
13:30	AMK Pk 1	13:30	Joo Koon/Gul	13:45	Toa Payoh
14:30	AMK Pk 2	15:15	Tuas	14:15	Kallang.W
15:00	Yishun	15:30	Kian Teck	14:45	Bedok
15:45	Senoko	16:00	IBP	15:15	Loyang
17:00	WDL	16:30	Hill View	15:45	Ubi
18:00	ASSAB	17:00	Bukit Batok	16:45	Bendemeer
		17:45	Joo Koon	18:00	ASSAB
		18:15	ASSAB		

## II. APPENDIX – THE INFORMATION FLOW

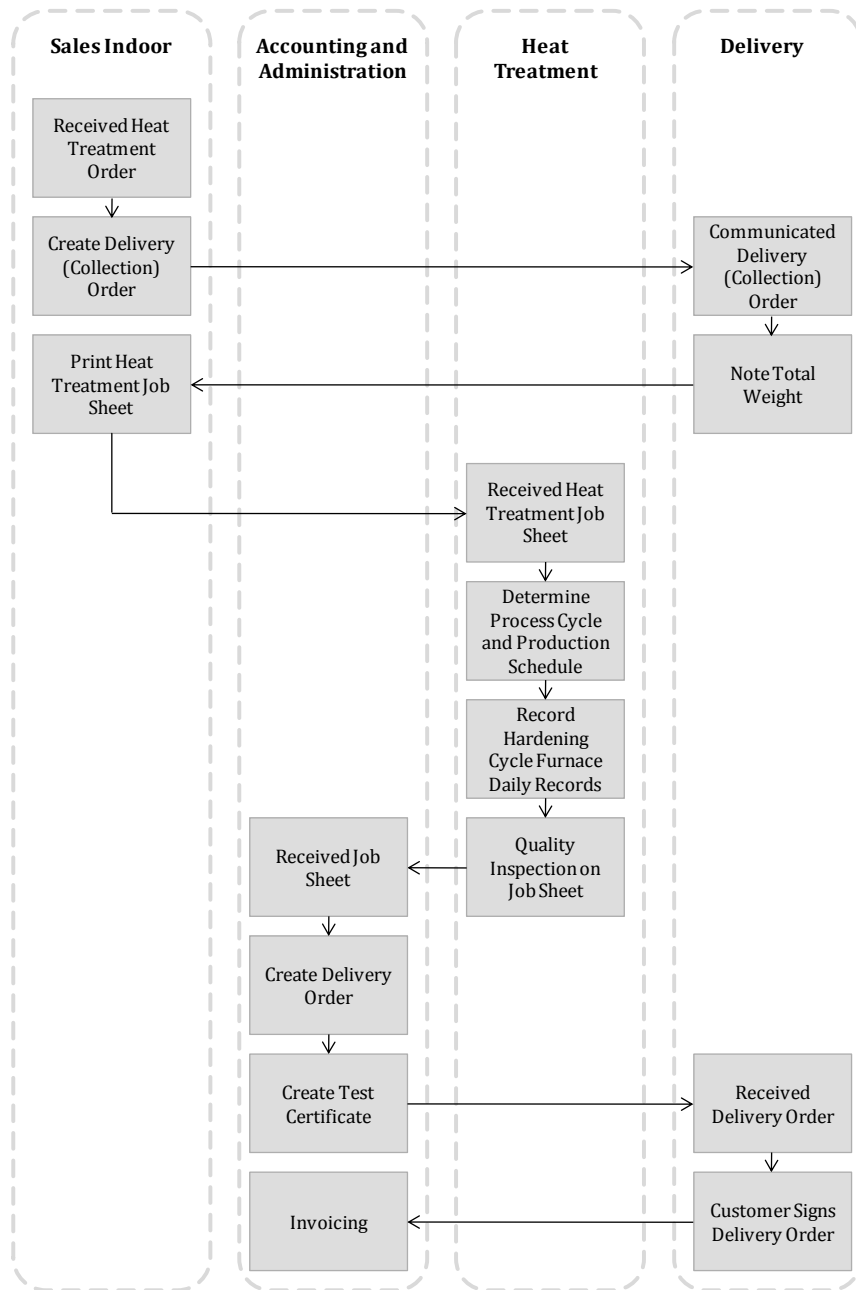
The information flow (Wee Kuong, 2010):

1. From received steel order to delivery order
2. From received heat treatment order to delivery order



### III. APPENDIX – FOCUSED INFORMATION FLOW

The information flow between *Sales indoor, Accounting and Administration, Heat treatment and Delivery* of a heat treatment order, from received order until invoicing (Wee Kuong, 2010).





## IV. APPENDIX – NEGOTIATION AND CONTRACTING AND EVALUATION OF THE COOPERATION

### NEGOTIATION AND CONTRACTING

Depending on the financial outcome of the evaluation, combined with services and quality requirements, the company will call for negotiation. The selection of suppliers should have indicated which suppliers are able to provide competitive alternatives. (Pewe et al., 2002)

According to Pewe et al. (2002), it can sometimes be effective to use a consultant service when negotiating. There are two different alternatives when using a consultant; the consultant can either handle the whole negotiation part and thereafter present a complete result, or be used to improve the company's own knowledge within the area of negotiation. In both cases, it is crucial that the consultant represent the transport market in a neutral way, which means that all possible alternatives will be presented and the company will have the opportunity to make selections during the project process. (Pewe et al., 2002)

When a supplier has been selected, a contract will have to be signed. The technical contents of the purchase agreement naturally depend on the product or the project that is to be purchased. For example, a contract for a service should be based on the supplier's performance. Legal terms and conditions vary between different contracts depending on company culture, market situation, product characteristics etcetera. (Van Weele, 2008)

According to Andersson (2007), a contract is important from several aspects. It will secure the buyer's and the provider's responsibilities, obligations and rights towards each other as well as distribute the risk of the collaboration. The contract will also protect and develop the companies' own and joint interests. (Andersson, 2007)

Van Weele (2008) discusses several important aspects of the contract which are presented below:

1. Prices and terms of delivery
2. Terms of payment
3. Penalty clauses and warranty conditions
4. Other arrangements

*Prices and terms of delivery* comprise different price arrangements that are used in purchase agreements. The contract type *fixed price plus incentive fee* is designed to motivate suppliers to perform their work above agreed standard. *Cost-plus contract* appears in different forms: cost-plus with a percentage fee, cost-reimbursable plus a fixed fee and cost-plus with a guaranteed maximum. Cost-plus contracts usually turns out to be more expensive for the buyer than other types of contracts. These kinds of contracts are used in situations where the service cannot be adequate specified or when a fixed price comprises too big risk for both buyer and provider. *Cost-reimbursable contracts* are usually based on a fixed hourly rate for labor and equipment. At last, for agreements with a long-term delivery, *agreement with price-adjustment* is used. (Van Weele, 2008)

In general, *terms of payments* are based on the supplier's performance. A certain percentage should be held back until the buyer is sure that the equipment operates in a satisfying way. When high value products are purchased it is common that payment takes place in several stages since the supplier will

have to make large investments. Advance payments should preferably be covered by a bank guarantee where the supplier agrees to fulfill its obligations. (Van Weele, 2008)

The *penalty clauses and warranty conditions* are a guarantee for the buying company that the supplier will fulfill its obligations. When buying a product it should guarantee good quality, completely new products that are free from defects but also that the delivered goods is legal and that government regulations have been met. (Van Weele, 2008)

*Other arrangements* that are common to record in the contract are insurance and safety regulations, transfer of rights and obligations, contracting out to third parties and terms of delivery. (Van Weele, 2008) When it comes to purchasing services Van Weele (2008) emphasizes that the two parties should make a *service level agreement* in order to have a clear understanding of what is expected from the service supplier. When a supplier meets the set goals he will receive full payment. On the other hand he will only receive partial payments if his performance does not meet the goals. (Van Weele, 2008)

### EVALUATION OF THE COOPERATION

Pewe et al. (2002) do not include this fifth step in their purchasing process but according to Andersson (2007) it is of importance. Andersson (2007) argues that the most important aspects when evaluating logistics solutions are related to time and quality of the processes as well as the arisen costs. Andersson (2007) presents a six steps analysis of a third-party logistics relationship:

1. Control of contract
2. Evaluation of total cost and service
3. Evaluation of development potential
4. Relationship between buyer and provider
5. Risk analysis
6. Result compilation

The most fundamental part regarding the *control of contract* is the evaluation. The buyer's and the provider's responsibilities should be clear in the contract as well as the objectives for the company's operations. The buyer should go through the contract in order to control whether it has been fulfilled or not. (Andersson, 2007)

In order to perform a relevant *evaluation of total cost and service* it has to be determined how important different criteria are for the company. Depending on the company, the requirements from the market and the position in the supply chain companies make different priorities between transportation cost and lead time for example. It is also important to consider what the buyer wanted to achieve when he contracted out the logistics activity. (Andersson, 2007)

According to Andersson (2007) *evaluation of development potential* is not relevant for all third-party logistics activities. But some companies that consult a third-party supplier are not satisfied with the supplier's involvement in the development of the service. In these cases it is suitable to evaluate the development potential in some instances. (Andersson, 2007)

The *relationship between buyer and provider* is difficult to evaluate and quantify (Andersson, 2007) but an important factor is trust between the parties (Sink et al., 1997).

When outsourcing a certain activity the included companies are exposed to several risks. These risks may involve extended problems and economical losses in several areas. Therefore it is important to perform a *risk analysis* in order to avoid risk in as large extent as possible. The risk analysis will contain the probability that the risk will occur and also its consequence for the companies involved. (Andersson, 2007)

The *result compilation* is simply a compilation of the evaluation. A presentation of the results regarding cost, service, development, relationship and risk can be showed in a result matrix. (Andersson, 2007)

## V. APPENDIX – CONTENTS OF AN RFQ

The contents of an RFQ according to Rushton et al. (2007, page 279):

1. Introduction, including confidentiality clause
2. Background to operating company
3. Business description
4. Data provided with the invitation to tender
5. Physical distribution specifications
6. Information systems
7. Distribution service levels and performance monitoring
8. Assets currently employed in distribution operations
9. Risk assessment and transfer
10. Industrial relations
11. Business relationship: contract type and contract management relationship
12. Charging structure
13. Terms and conditions
14. Environmental issues
15. The selection process, including key selection criteria
16. Response format
17. Criteria for award of contract
18. Timescale and method of submitting clarification questions regarding the RFP<sup>5</sup>
19. Deadline for submission of a response to the RFP
20. The proposed start date for the contract after award

End of quote.

Typical logistics data requirements for the RFQ (reduced version from Rushton et al, 2007, page 280)

STORAGE AND ORDER PICKING	DELIVERY
<u>RECEIPT</u>	<u>DESPATCH</u>
Number of suppliers	Outlets including location
Extent of palletization	Delivery quantity by location
Notice given for time of delivery	Peak variations
Extent of inspection or check	
Dealing with returns	<u>DELIVERY</u>
	Constraints on delivery times
<u>THROUGHPUT</u>	Problems at specific locations
Seasonal/daily variations in volumes	Delivery methods
<u>ORDER PICKING</u>	<u>SERVICE</u>
Order transmission procedure	Service level requirements
Order volumes including seasonal and daily variations	
Service time cycles for receipt to delivery	<u>OTHERS</u>
Lines per order and total quantity per order including peak variations	Returns
	Repacking, stock checking

<sup>5</sup> RFP is an abbreviation of Request for Proposal which is another name for Request for Quotation, RFQ.

## VI. APPENDIX – SUPPLIER SELECTION CRITERIA

Dickson's (1966) supplier selection criteria:

1. The ability of each supplier to meet *quality* specifications consistently
2. The ability of each supplier to meet specified *delivery schedules*
3. The *performance history* of each supplier
4. The *warranties and claims policies* of each supplier
5. The *production facilities and capacity* of each supplier
6. The *net price* (including discounts and freight charges) offered by each supplier
7. The *technical capability* (including research and development facilities) of each supplier
8. The *financial position* and credit rating of each supplier
9. Compliance or likelihood of *compliance with your procedures* (both quoting and operating) by each supplier
10. The *communication system* (with information on progress data of orders) of each supplier
11. The *position in the industry* (including production leadership and reputation) of each supplier
12. The *desire for your business* shown by each supplier
13. The *management and organization* of each supplier
14. The *operational controls* (including reporting quality control and inventory control systems) of each supplier
15. The *repair service* likely to be given by each supplier
16. The *attitude* of each supplier towards your organization
17. The *impression* made by each supplier in personal contacts with you
18. The ability of each supplier to meet your *packaging* requirements for its products
19. The *labor relations record* of each supplier
20. The *geographical location*
21. The *amount of past business* that has been done with each supplier
22. The availability for training *aids* and educational courses in the use of the product of each supplier
23. The *future purchases* each supplier will make from your company

## VII. APPENDIX – THE REQUEST FOR QUOTATION

# Request for Quotation

---

- Steel deliveries within Singapore -

For additional information or questions, please contact:

Sofie Jönsson

ASSAB Pacific PTE LTD

Email: [logistics@assabpac.com.sg](mailto:logistics@assabpac.com.sg)

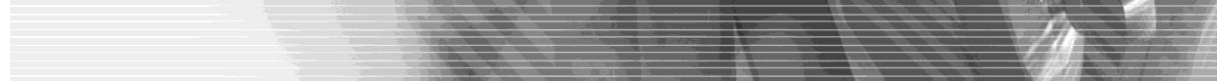
Telephone: +65 6534 5600

Madeleine Lundgren

ASSAB Pacific PTE LTD

Email: [logistics@assabpac.com.sg](mailto:logistics@assabpac.com.sg)

Telephone: +65 6534 5600



## INTRODUCTION

Your firm has been selected to receive this Request for Quotation (RFQ) based on research of local courier service suppliers. Four suppliers have been invited to respond to this RFQ.

Response to this RFQ is kindly required by 16-04-2010, delivered to ASSAB Pacific, on:

*logistics@assabpac.com.sg*

or to:

*ASSAB Pacific Pte Ltd  
171 Chin Swee Road  
# 07-02 SAN Centre  
Singapore 169877*

We appreciate your interest in this RFQ. Please contact us if you have questions about the RFQ or difficulties meeting the time requirement.

All information in this RFQ is confidential until ASSAB Pacific gives further notice.

## BACKGROUND

ASSAB Pacific is the commissioning body of this RFQ whereas the quotation regards the transports of one of its subsidiaries, ASSAB Singapore. The transportation concerned is delivery of goods between ASSAB Singapore's distribution center and its existing Singaporean customers. In the section *Scenarios*, three scenarios for negotiated goods are presented.

## DESCRIPTION OF THE PRODUCTS

ASSAB Singapore offers its customers high quality tool *steel* in varying shapes and sizes. The steel is sold as round bars, cubes, rectangular blocks as well as thinner but wider rectangular plates. The weight of a delivery ranges from a few grams to several tons; see *Appendix* for the weight distribution.

Besides the steel, customers are also offered a value adding service, *heat treatment*, of their purchased material. This service is performed after the customers have produced their tools. This means that the customers' tools must be returned to ASSAB Singapore's distribution center for heat treatment and thereafter be delivered back to the customers, i.e. two deliveries are needed.



## DISTRIBUTION STRUCTURE

The distribution between ASSAB Singapore and its customers can be categorized into *Steel products* and *Heat treatment products*.

### STEEL PRODUCTS

*Steel products* are delivered from ASSAB Singapore to its end customers around Singapore. In general the steel does not need any special packaging or handling. Though there are some exceptions of steel products that have to be sheltered from rain due to machine processing before delivery.

### HEAT TREATMENT PRODUCTS

*Heat treatment products* are value added material delivered from either:

1. ASSAB Singapore's customers to ASSAB Singapore's distribution center
2. or, from ASSAB Singapore's distribution center to ASSAB Singapore's customers

Heat treatment products are either wrapped in plastic stretched film or newspapers before transportation to prevent damage to the customers' goods during delivery.



## GEOGRAPHICAL COVERAGE

ASSAB Singapore has divided the Singaporean market into three regions, illustrated on the map below:

1. Jurong
2. Town
3. Ang Mo Kio & Woodlands (AMK & WDL)

These geographical regions are used by ASSAB Singapore when planning transportation routes and are illustrated in the figure below. It is not a requirement to base quotation prices on these regions. An approximation of these regions is presented simply to give an idea of ASSAB Singapore’s customers’ locations in Singapore.



This RFQ concerns transports between ASSAB Singapore’s distribution center at *18 Penjuru Close Singapore 608616* and its Singaporean customers. Therefore the regions in Singapore and their number of customers as well as number of deliveries per year are presented.

NAME OF REGION	NUMBER OF CUSTOMERS	NUMBER OF DELIVERIES PER YEAR
Jurong	103	5 900
Town	137	4 700
AMK & WDL	92	4 700

The number of Singaporean customers and total order frequency in the table are based on the sales of 2009, why ASSAB Singapore reserves the right for smaller changes in future demand.



## SCENARIOS

In this section, three scenarios will be presented. The scenarios represent different parts of ASSAB Singapore's assortment that are to be delivered to the customers. Each scenario is based on a weight limit and includes all deliveries below this specific limit.

The number of deliveries stated below is based on information retrieved from historical data from 2009. ASSAB Singapore therefore reserves the right for changes in number of deliveries that might occur due to fluctuations in demand.

### SCENARIO I

In Scenario I the weight limit is set at 30 kg. The request for this scenario is therefore a quotation for all of ASSAB Singapore's deliveries below 30 kg.

WEIGHT LIMIT	NUMBER OF DELIVERIES PER YEAR
30 kg	10 676*

\* Jurong: 4 394 deliveries, Town: 3 326 deliveries, AMK & WDL: 2 956 deliveries

### SCENARIO II

In Scenario II the weight limit is set at 80 kg. The request for this scenario is therefore a quotation for all of ASSAB Singapore's deliveries below 80 kg.

WEIGHT LIMIT	NUMBER OF DELIVERIES PER YEAR
80 kg	13 228**

\*\* Jurong: 5 248 deliveries, Town: 4 158 deliveries, AMK & WDL: 3 822 deliveries

### SCENARIO III

In scenario III all deliveries at ASSAB Singapore are included. The dispersion of weights vary between 48 g to 7 670 kg with an average of 47 kg. Please review *Appendix* for further details on ASSAB Singapore's dispersion of delivery weights.

WEIGHT LIMIT	NUMBER OF DELIVERIES PER YEAR
No limit/ all deliveries	15 347***

\*\*\* Jurong: 5 911 deliveries, Town: 4 744 deliveries, AMK & WDL: 4 692 deliveries



## **DISTRIBUTION SERVICE LEVELS**

Concerning this RFQ, ASSAB Pacific has demands on two delivery service levels: *delivery reliability* and *delivery lead time*. Your quotation should be based on calculations that satisfy these two demands.

### **DELIVERY RELIABILITY**

*Delivery reliability* is here defined as how well the real delivery time corresponds to the time promised when the order was placed, i.e. on-time delivery.

The demanded delivery reliability in this RFQ is 100%.

### **DELIVERY LEAD TIME**

*Delivery lead time* is here defined as either:

- The time between picking up the goods at ASSAB Singapore's distribution center's loading zone and the delivery at the customers' loading docks.
- The time between picking up the goods at the customers' loading docks and the delivery at ASSAB Singapore's distribution center's loading zone.

In this RFQ the demanded delivery lead time is divided into two cases:

- a. Delivery before 12.00, the same day
- b. Delivery before 18.00, the same day

## PRICE AND TERMS

For the quotation structure ASSAB Pacific wishes the price to be stated in two parts: base price and additional prices, if any. The prices should be calculated with consideration to the delivery service levels stated in the section *Distribution service levels*, 100 % delivery reliability and two cases for the delivery lead time.

## DURATION OF THE CONTRACT

The RFQ concerns a contract duration of two years with start 01-08-2010.

## BASE PRICE

A fixed total base price per year for each of the three scenarios should be stated in your quotation. Please present your fixed total base price per year in a table as the one illustrated below:

	FIXED BASE PRICE PER YEAR [SGD] 100% DELIVERY RELIABILITY A) DELIVER BEFORE 12.00	FIXED BASE PRICE PER YEAR [SGD] 100% DELIVERY RELIABILITY B) DELIVER BEFORE 18.00
Scenario I ≤ 30 kg		
Scenario II ≤ 80 kg		
Scenario III No limit		

## ADDITIONAL PRICES

If any additional prices may arise during the duration of the contract, these additional costs will have to be included in the quotation. Additional prices concern potential extra charges due to different fluctuating costs such as:

- Fluctuation of fuel cost
- Fluctuation in number of deliveries

ASSAB Pacific kindly requests these additional prices to be declared in appendixes. Preferably they should be constructed as price templates including levels for price changes. If you do not attach any templates please confirm that no additional prices will arise.

## IT SYSTEM

Please state your IT system in order to enable an evaluation of Electronic Data Interchange (EDI) possibilities.

## APPENDIX

### LENGTH OF SOLD ITEMS

LENGTHS	[MM]
Maximum length	10 000
Average length	218

### DISPERSION OF ALL DELIVERY WEIGHTS

DELIVERY WEIGHT	[MM]
Total	719 931
Maximum	7 670
Minimum	0,048
Average	47
Median	13

### DELIVERY WEIGHTS AND CORRESPONDING PERCENTAGE OF TOTAL NUMBER OF DELIVERIES

DELIVERY WEIGHT [KG]	PERCENTAGE OF DELIVERIES [%]
≤ 10	43.12
≤ 20	60.76
≤ 30	69.56
≤ 40	75.32
≤ 80	86.19
≤ 160	93.61
≤ 320	97.69
≤ 640	99.42
≤ 1 280	99.87
≤ 2 560	99.97
≤ 5 120	99.98
≤ 7 670	100.00