ABSTRACT

As companies strive for getting the upper hand on the competition, there is one area that is receiving increasing interest, namely logistics. In this thesis, our contribution to the knowledge of how a competitive advantage can be created within the heavy equipment industry is presented. This is conceptualized in the model 'Holistic competitive advantage', which demonstrates the importance of managing the flows of products, information and financial transactions efficiently from the moment an order is placed until the customer pays for the product. This model is based on a process perspective that crosses functional boundaries in order to highlight the benefits of taking a truly holistic view of a companies international activities when designing a competitive strategy.

By reviewing the activities related to the order-to-payment process, scopes for reducing costs and lead-time are greater than when taking the traditional approach of improving certain logistical functions within an organization. At the same time customer service is improved.

Volvo Construction Equipment has been used as the case study company in this thesis. Its production of heavy and bulky machines in distant locations for the Southeast Asian and Australian markets forms an excellent example to study since its products pose rather specific requirements in terms of transportation, warehousing and after market support.

Key words: competitive advantage, lead-time, logistics, order-to-payment, supply chain management

"Strategy is the art of making use of time and space"

Napoleon Bonaparte

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Our tutors Hans Jansson and Sten Söderman has also given us strong support in finalizing this thesis. The insight and commitment they have shown have been much appreciated. By forcing us to challenge our perceptions and encouraging us to scrutinize a problem from different angles we believe that our thesis has become a better one. We thank them for their time and efforts.

Richard Andersson Håkan Nylander

TABLE OF CONTENTS

FIGURES

TABLES

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1. POINT OF DEPARTURE

There is not a single company today that is not affected by the globalization of the world economy. As countries are deregulating, opening up barriers to the free flow of goods, services and capital, the battlefield for Multinational Corporations (MNCs) becomes increasingly larger. But at the same time, the dramatic development in communication, information and transportation technologies is shrinking the distances between markets.

These trends have come to influence the field of logistics in a revolutionary way. More and more companies have come to the conclusion that by using new logistics techniques and methods they can lower their cost significantly, increase delivery reliability, shorten lead-times and improve customer service. As a result, several companies have created a competitive advantage. The biggest success stories can be found in the retailing industry, where companies like Wal-Mart and Dell have understood the importance of managing the supply chain. By using the state of the art distribution technologies, Wal-Mart in 20 years went from being a small local retailer in the U.S. to become the largest retailer in the world. In one of the most competitive markets Dell managed to become the second biggest computer systems supplier in the world, by selling directly to end customer. What Wal-Mart and Dell did was to find new ways of distributing the products in industries that were in transition. These success stories have put logistics on the agenda for most company top managers.

An industry that is going through an interesting restructuring phase is the construction equipment industry. The two most significant forces behind the change in the industry are scale economies and worldwide coverage. A company that has been very active in that sense is Volvo Construction Equipment, which will be shortened to Volvo CE in this thesis. To create economies of scale Volvo CE have concentrated manufacturing to a few

locations, making distribution to distant markets challenging. In addition, all manufacturers in the industry are struggling with two issues: how to cut cost and how to improve customer service. These issues are very interesting since there is a direct link to logistics.

1.1 An evolving area of study

The academic field that most often is referred to as logistics is very broad and fragmented. There is no coherent theoretical framework describing all the different outgrowths in an integrated way, resulting in a disarray of different concepts and theories explaining the same phenomenon.

An interesting development of logistics is supply chain management, which not only considers the functional parts in the company, but takes also a more holistic view of the company's internal and external activities. The interest in this concept has increased significantly during the last couple of years, mainly because of the developments in information technology.

Even if several researchers argue that logistics has a strong impact on how a company is performing, we have seen few authors linking it to competitive advantage. What we lack is a theory or model that links logistics with creating a competitive advantage.

During recent years the interest in arranging logistic activities to suit customer demand has increased significantly. This has put some pressure on traditional theory, where supplying products to markets has been seen as the core activity. Today, everything starts with the customer and ends with the customer. Thus, the circle is closed.

In addition, there is a growing tendency to analyze the logistics from a process perspective, which in turn increases scopes for a holistic understanding of how the logistics design influences a company. Examining the processes involved from the moment when a customer order is placed until the customer pays for the product involved, the so-called

order-to-payment process is an instrument that grows in popularity within companies and academia. Traditionally, when studying logistical activities, the focus has been on how they are associated with costs. Recently, researchers have argued that lead-time is a more proper measurement of logistical performance since it evokes costs.

The academic interest in international logistics and supply chain management issues is increasing as companies are focusing on working more globally. However, we have found that the current academic findings seldom take a truly international perspective. What is lacking is a framework dealing with international logistics issues for MNCs. This is especially the case for companies working with bulky products that are sold in small quantities. Consequently, their logistical needs are quite different from those companies working with large quantities. The academic interests in these companies are still very marginal.

For MNCs, managing the financial transactions becomes increasingly important when dealing with various currencies. This was earlier perceived solely as a financial issue, but as companies audit their supply chain, the linkages between logistics and financial transactions become apparent. Finally, the academic interest in better coordination and exchange of information through the supply chain, which could improve lead times, is another area that needs stronger focus, according to Storhagen (1999).

The above reasoning has led us to the following main problem:

Main Problem:
"Considering the globalization of markets, how does an MNC, operating in the heavy equipment industry, enhance its competitiveness by more efficiently managing its order-to-payment process, when manufacturing and markets are located at long distance apart?"

1.2 Research problems

Research problem 1

How can the distribution of bulky products to customers in Southeast Asia and Australia become more cost efficient?

In this study Southeast Asia (SEA) and Australia are areas representing markets located far away from the sites of manufacturing. As such, they are appropriate markets to study since the long distances have implications on proper distribution.

The first research problem will consider the following areas:

- Inventory holding costs
- Lead-time
- Number of warehouses
- Transportation

One of the most important processes in the order-to-payment (OTP) process is the distribution of the product. The traditional view of dealing with heavy equipment that is to be transported a long distance has been to hold a large inventory, to be able to supply customers relatively fast. This has led to large inventory holding costs. New theories have recently emerged that propose a new way of dealing with this problem. Many companies have reduced their overall costs when reducing inventory and fasten-up distribution lead-time. An important factor in achieving this has been to revise the position and number of warehouses.

Research problem 2

How can a better administration of information reduce lead times and financial risks in a company?

The second research problem will consider the following areas:

- Financial transactions
- Forecasting
- Information handling
- Lead-time

The comprehension of the importance of managing the information running through a company is increasing. But what most companies fail to recognize is the effect information has on a variety of activities in a company. The forecasting of future sales, which is heavily dependent upon accurate information, has a large impact not only on the distribution and inventory holding of products, but also on financial transactions. Recently, researchers have also found that poor information handling is a major cause of long lead-times in the supply of products.

1.3 Delimitations

Within the frames of our problem definitions we have made certain limitations in this study:

- Logistics is divided into two main concepts: materials management and physical distribution. We focus on physical distribution, i.e. a company's outbound activities taking place after the manufacturing processes have ended. As such, we will not look into areas of inbound logistics activities such as materials handling or manufacturing. However, we will take their implications for physical distribution into account when deemed necessary.

- The intention is to examine the activities ranging from the moment when an order is placed until the customer receives and pays for the product. Consequently, we do not study activities occurring before an order is placed. It is, however, difficult to limit certain factors from this frame, such as the pre-order information. We have

therefore included such information that is closely linked to the process of OTP.

- We do not intend to study the distribution of non-bulky products to chosen markets. The reason for not including spare parts, attachments etc. is that the logistical challenges are of a completely different nature from those usually associated with bulky products.

- As we conduct a study on two particular markets, we do not make generalizations regarding other markets. Neither do we take into account implications of our findings on other markets.

1.3.1 Case Company delimitation requests

Our research problems have been developed in close co-operation with Volvo CE. It has been jointly decided that the following areas are to be excluded from this study:

- Distributions of other products but machines are to be excluded. During the research process we have, however, understood that competitive advantage in the heavy equipment industry is to a large extent related to what is labeled soft products, e.g. financing, rental, customer support, spare parts etc. We have not examined those areas in-depth due to the reason earlier mentioned, but since it represents such an important part of creating a competitive advantage in this industry it cannot be neglected. We have therefore complemented the study with discussions about the major impact soft products and organizational structures have on competitive advantage.

- In addition, we have excluded products with relatively low frequency of sales.

1.4 Purpose of the thesis

The main purpose of this thesis is to create a model that demonstrates how a company in heavy equipment industry can create a competitive advantage on the SEA and Australian markets by managing its OTP process more efficiently when distances to customers from sites of manufacturing are long. A case study of Volvo CE will be conducted in order to explore how to create efficiency improvements in the OTP process. We also have two sub-purposes. Firstly, we will map the flows related to OTP process of Volvo CE and identify areas of improvement. Secondly, we intend to explore which activities that enhance a company's competitiveness in the heavy equipment industry.

1.5 Outline

The point of departure in this Master thesis has been to present the background to the area that is studied (see figure 1.1). The main problem as well as research problems has been presented. In addition, delimitation and purpose have been stated. Chapter two presents the theoretical framework, i.e. the theories and models that have been the backbone in understanding the different concepts in logistics and supply chain management. A discussion of competitive advantage is also presented to explain how competitiveness can be perceived. To state our viewpoints, a conceptual discussion is held at the end of the chapter. In chapter three, the methodology that we have used is presented. How we collected and analyzed the data is offered as well as the reasons for conducting a case study. We also discuss the quality of the research we have conducted.

In chapter four, the empirical evidence is presented and it is divided into three different parts: product, information and monetary flows. In addition a presentation of Volvo CE will be given. To understand the relevance of the three flows we have put them in an analysis context of the heavy equipment industry. These issues are discussed in chapter five. In the subsequent chapter, an analysis of Volvo CE's OTP process is presented. Underlying reasons are discovered that lead to a generation of different

alternatives. Chapter seven presents our theoretical findings and a model of how to achieve competitive advantage. Finally, in chapter eight our recommendations for Volvo CE and future research are presented.

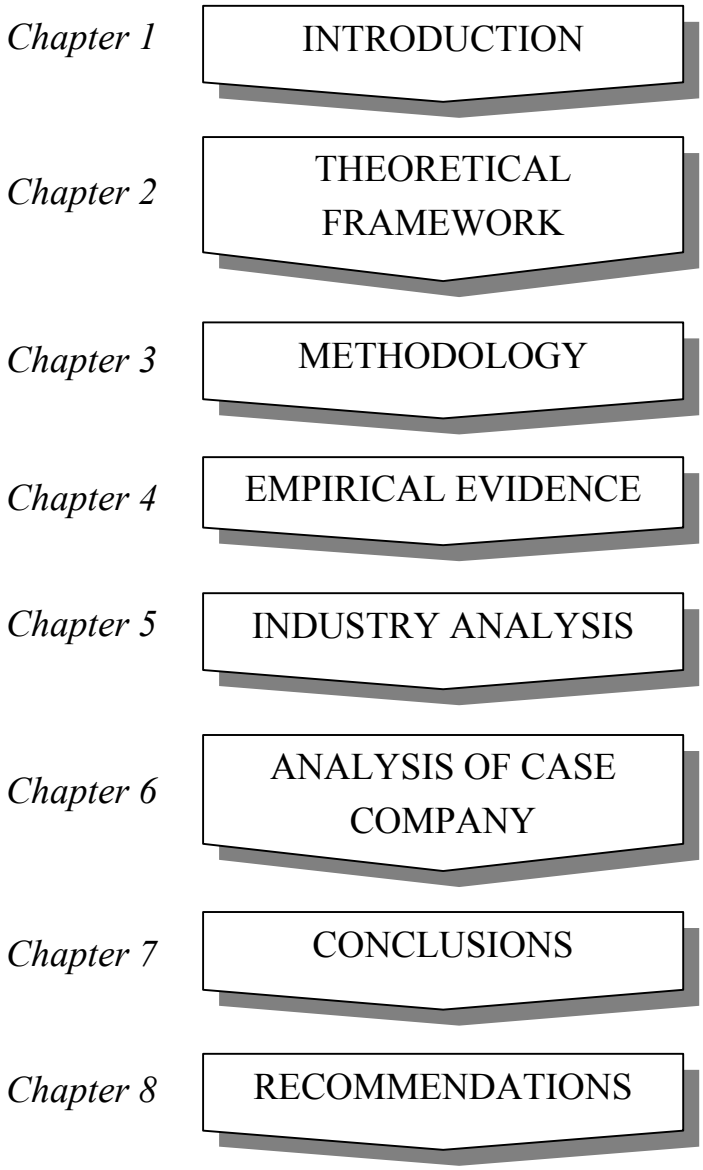


Figure 1.1 Outline of Master thesis

2. THEORETICAL FRAMEWORK

In this chapter we will present the concept of competitive advantage. How this is linked with logistics will lead to a description of current findings in logistics and supply chain management. The concept of order-to-payment will then be thoroughly discussed. Finally, a conceptual discussion showing our views will conclude this chapter.

2.1 A new definition of competitive advantage

Porter (1985) has probably developed the theories, that have been embraced most, both by researchers and practioners, theories on how companies can achieve competitive advantage. His definition of competitive advantage is:

"Competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firms' cost of creating it. Value is what buyers are willing to pay, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price." (Porter, 1985 page 3)

An important feature of this definition is to create value-adding activities. Furthermore, to achieve a competitive advantage Porter argues that there are two ways to do so. One is to be the cost leader, the other one is differentiation.

More recent definitions of competitive advantage can for example be found in Grant (1998):

"When two or more firms compete within the same market, one firm possesses a competitive advantage over its rivals when it earns a

persistently higher rate of profit (or has the potential to earn a persistently higher rate of profit).” (Grant, 1998 page 174)

The difference from Porter’s definition is clear, as Grant’s definition is focused on profitability as a measure of success, whilst Porter focuses on perceived value. Another interesting distinction between Porter’s and Grant’s views of competitive advantage is where they stem from. Porter argues that the industry is the most important variable to monitor in order to be successful. Grant, on the other hand, focuses on the resources and capabilities a company possesses. Porter has an external focus, while Grant has an internal focus. We believe that these two concepts form an excellent combination for how to perceive competitive advantage.

2.1.1 First mover advantage

Closely related to competitive advantage is the concept of first mover advantage, which is the economic and strategic advantage that accrues to early entrants into an industry (Lieberman and Montgomery 1988). A company that gains economies of scale might be able to get a lock on the world market that discourages other companies to enter the industry. This could also be achieved by building brand loyalty early and getting experience of business practices in a new country (Hill 1998). The company that gets a first mover advantage is also the one that gains access to resources and capabilities that a follower cannot match (Grant 1998).

2.1.2 Resources and capabilities

Grant (1998) argues that the there is a strong relationship between resources, capabilities and a competitive advantage. Resources can be divided into tangible, intangible and human. Tangible resources are usually the easiest to identify and evaluate. Financial and physical assets could be found in the company’s financial statement. Intangible resources are more difficult to evaluate. These resources could be the technology or reputational assets the company possesses (brands, for example). The last

resource to consider is the human one. This resource that often is referred to as the human capital of a company, could be the specialized skills and knowledge of employees. Other resources could be communication and interactive abilities as well as motivation among employees. The relationship with competitive advantage is shown in figure 2.1.

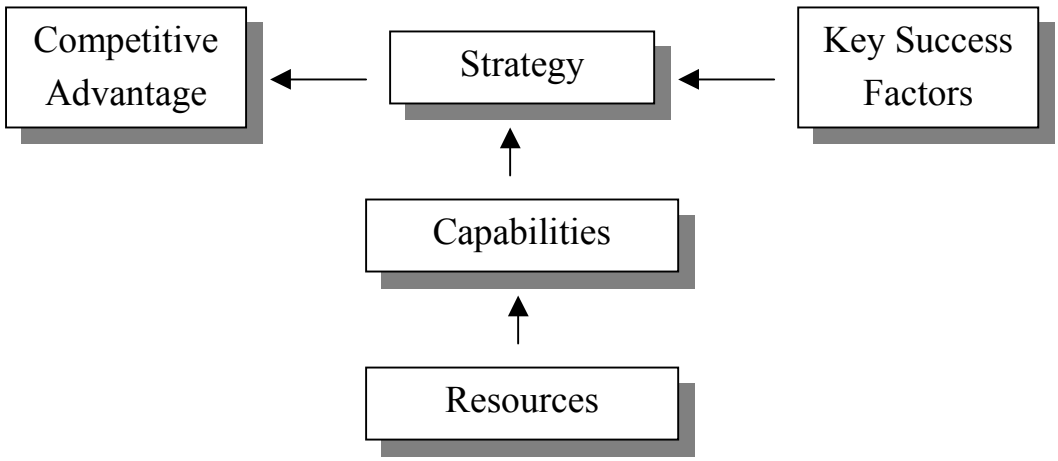


Figure 2.1 The relationships among resources, capabilities and competitive advantage. ***Source: Grant (1998)***

However, resources are not productive on their own. There needs to be some form of collaboration between resources to achieve a certain activity. This is usually referred to as organizational capability or competence. Hamel and Prahalad (1990) make a distinction between competencies and core competencies. A core competence is one that:

- Offers real benefits to customers
- Is difficult for competitors to imitate
- Provides access to a variety of markets

Hamel and Prahalad (1990) argue that core competencies are those that are fundamental to a firm's performance and strategy. Grant (1998), on the other hand, states that the capabilities per se are not interesting, but

capabilities relative to other firms are. The establishment of a competitive advantage requires that a firm identify what they can do better than its competitors.

2.1.3 Key success factors

Another important factor to consider when striving for competitive advantage is the key success factors in an industry. Ohmae (in Grant 1998) argues that to identify key success factors companies need to ask two questions:

1. What do customers want?
2. How does the firm survive competition?

The first question deals with the demand side of the business. On the most basic level a company must analyze who their customers are and what they want. The second question focuses on the competition. Important issues to consider are the basis of competition in the industry, competitive intensity, and how to obtain a superior competitive position.

By considering key success factors, as well as the company's resources and capabilities when designing a strategy, a company could achieve a competitive advantage according to Grant (1998).

2.1.4 The strategy concept

Among all the concepts in academia and real business life today, strategy is probably the most ill defined. There are as many definitions as practitioners. The reason for this is probably that the concept can be used to describe numerous themes.

In a recent attempt to distinguish between the different views, or as they are often referred to in academia, 'schools', Ahlstrand et al (1999) distinguish between 10 different schools, see appendix 1. The point Ahlstrand et al

makes with this division is that there is not one school that presents the best view, rather that they all complement each other.

According to Kay (1999), most commentators agree that business strategy is concerned with the match between a company's internal capabilities and its external environment. Strategy is no longer about planning, visioning or forecasting. Rather, strategy is about using a set of analytic techniques for understanding and influencing a company's position in the market place. Prahalad (1999) takes this a step further and argues that strategy is not about positioning the company in a given industry space, but rather about influencing, shaping and creating it.

2.1.5 The marriage between competitive advantage and logistics

Since Grant (1998) states that profitability is the prime determinant of competitive advantage it becomes very interesting to analyze what creates profit. In this section we will show that there is a strong relationship between logistics activities and the profitability of a company.

To measure how a company is performing, there are several ways to go about. According to Grant (1998), return on capital employed (ROCE) remains to be the most useful and widely deployed indicator of profitability and value creation in Multinational Companies. Du Pont originally created the ROCE ratio in 1919 (Gustavsson and Svernlöv, 1994). It is a hierarchy of different financial ratios based on the simple relationship between margin management and asset management. Three commonly used ratios are net profit margin, asset turnover and return on assets. For a description of the different ratios, see appendix 2. The relationship between financial performance and logistic activities is strong, which is illustrated in Gattorna and Walter's (1996) model (see figure 2.2).

By increasing the customer service, e.g. fast and accurate deliveries, sales volume increases and improves the profitability. The same will be achieved

by lowering the cost of procurement, handling and manufacturing. The ROCE ratio will also be improved by managing the capital employed more effectively. Ordering processing, transportation mode, inventory management, and debt collection all have a dramatic impact on how much capital will be tied up.

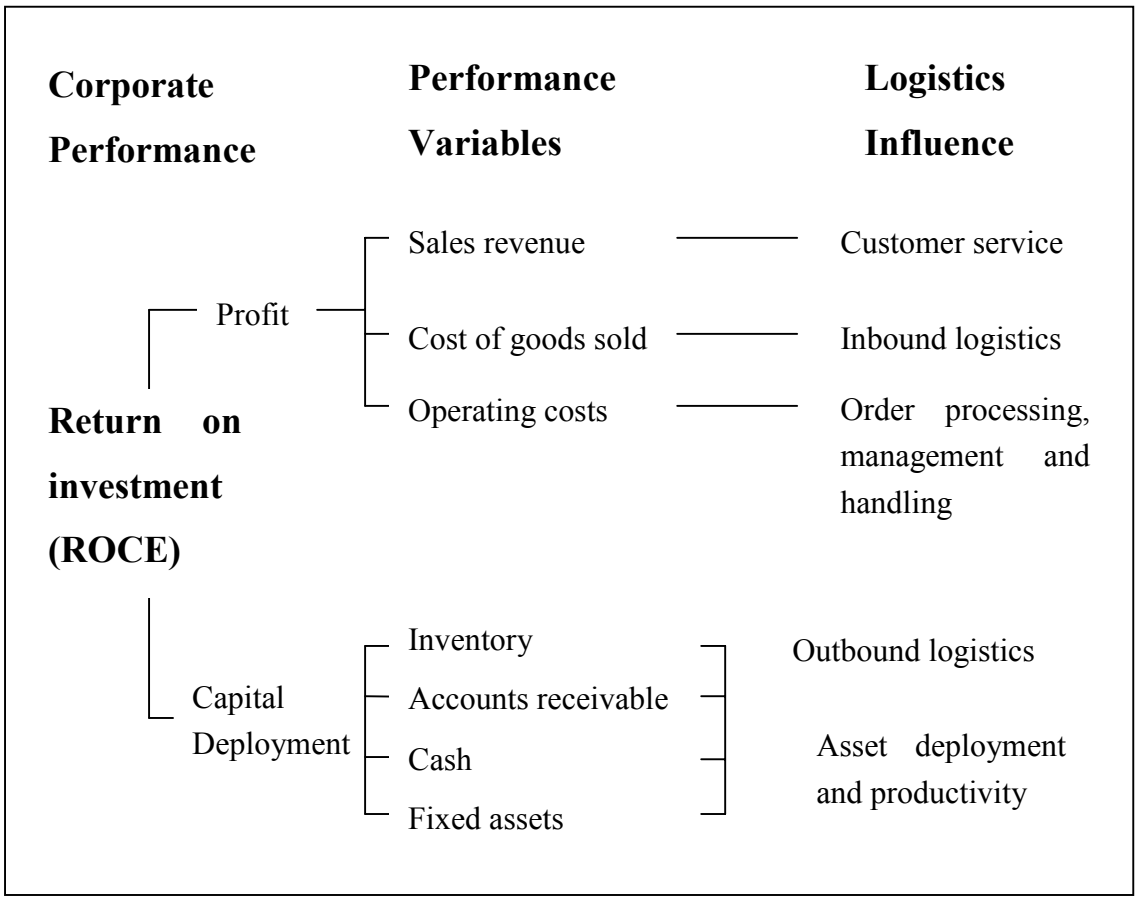


Figure 2.2 Impact of logistics on corporate financial performance
Source: Gattorna and Walters (1996)

Consequently, what becomes obvious is that the logistics activities have a large impact on the value that is created within companies. By more effectively managing the supply chain and improving the customer service, companies can create more value for their customers and simultaneously improve profitability. Thus, there is a strong link between competitive advantage and logistics.

2.2 Logistics and Supply Chain Management

Logistics as an academic field of study is fairly new and the relative newness of the subject, has led to an emergence of several concepts describing more or less the same thing. Terms such as physical distribution, materials management, business logistics, integrated logistics, logistics management, and supply chain management are frequently used. The concepts really flourish and Henkoff (1994) has a point when he writes:

"Call it distribution or logistics or supply chain management. By whatever name, it is the sinuous, gritty, and cumbersome process by which companies move material, parts and products to customers." (Henkoff, 1994 page 64)

2.2.1 The historical evolution of Logistics

Since the 1960s, the concept of logistics has gone from being a rather fragmented concept to become more integrated. In the 1970s, when the interest for just-in-time (JIT) manufacturing arose, logistics activities started to become more integrated and two concepts emerged as the prevailing ones: materials management and physical distribution. Materials management regards inbound logistics, i.e. all steps involved when a company procures raw materials from a supplier. Physical distribution, on the other hand, concerns all steps involved from when a finished product is to be delivered to a customer. The characteristics of these two concepts are illustrated in table 2.1. The concepts later became what are termed logistics or logistics management. Christopher (1992) has defined logistics as:

"The process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfillment of orders." (Christopher, 1992 page 2)

MATERIALS MANAGEMENT	PHYSICAL DISTRIBUTION
Production planning Optimizing production resources	**Transportation** Physical movement of goods and mode of transportation.
Procurement Securing and ordering of raw material, components or finished goods.	**Finished goods inventory** Inventory and warehouse management.
Packaging The requirements for moving and storing the goods.	**Forecasting** The activity of foreseeing the demand
Materials handling Concerned with how efficient a warehouse operation is run.	**Customer service** Service levels decisions on inventory size, transportation modes and warehouse selection.
Inventory management Storage of raw material and components.	**Order processing** Order routines and receptions and general information provision.

Table 2.1 Materials management and Physical distribution,
Source: Coyle et al (1992), Ross (1998)

Put more simply, logistics treats the issue of making the correct product available in correct numbers of units with the correct quality, transferred in the most appropriate manner on desired time to the correct customer, and at the correct price level. Such a description, according to Persson and Virum (1996), pinpoints the essentials of logistics, namely to create time and geographical value to the customer.

2.2.2 Supply chain management emerges

Throughout the 1990s, the concept of logistics has developed even more. The recognition that perceiving logistics systems from a more holistic perspective, including suppliers, distributors, and customers into one major supply chain of activities, provides a better scope for profitability. Many companies have outsourced activities outside their core business to enhance efficiency and created strategic networks with other companies to obtain necessary non-core business resources. In that way, companies become linked into inter-company activity chains where each chain member contributes its particular core competencies. This is termed supply chain management. However, the concept of supply chain management has no unified definition. After reviewing several definitions, we have come to the conclusion that Ross (1998) gives the most comprehensive one:

"Supply chain management is a continuously evolving management philosophy that seeks to unify the collective productive competencies and resources of the business functions found both within the enterprise and outside in the firm's allied business partners located along intersecting supply channels into a highly competitive, customer enriching supply system focused on developing innovative solutions and synchronizing the flow of marketplace products, services, and information to create unique, individualized sources of customer value." (Ross, 1998 page 9)

2.2.3 Factors influencing Logistics

There are many factors to consider when designing a proper logistics strategy. The most important ones to have in mind when companies develop their logistics strategy are shown in table 2.2.

Factors	Reasons
Product characteristics	Need of warehousing, inventory and transport is basically set by the product characteristics. E.g. bulky products have implications for transport options, and it is unwise to store high-value products for long periods of time since they tie capital.
Company characteristics	The basic philosophy is making up the level of marketing orientation of a company, e.g. how customer service, delivery frequency and reliability are perceived as important or not.
Customer characteristics	The customer requirements are becoming more demanding, which means that companies must do their outmost to satisfy their needs, e.g. faster deliveries.
Market structure	The competitive situation and geographical distances between site of manufacturing and customers are two key factors. As competition grows, it becomes increasingly important to be more efficient and customer-oriented than competitors.

Table 2.2 Factors that influence logistics design
Source: Ballou (1990) and Gattorna and Walters (1996)

2.3 From functions to processes

There is a growing tendency among companies and researchers to examine problems in terms of processes. The popular concept of Business Process Reengineering (BPR) that emerged during the 1990s is one example. A

process analysis is different from a traditional analysis in the sense that it focuses more on "what and how" activities are carried out, from start to finish, instead of focusing on "who" undertakes the activity.[1] To examine an entire process means that the analysis crosses functional boundaries and offers scopes for an overall holistic understanding of how well companies carry out their activities. It then becomes easier to identify critical activities, how many resources that are allocated and consumed, and how well companies are performing the processes.

Having such a process perspective when analyzing logistics performance is in contrast with the traditional evaluation procedures. Earlier the focus was rather on how different activities were performing in isolation from other activities in the entire logistical process. We believe that an evaluation of the logistical performance is more accurate when perceived from a total process perspective, and will therefore develop concepts in relation to this perspective.

2.3.1 The importance of lead-time

An important aspect in logistical processes are the concept of lead-time. Lead-time is the amount of time an activity takes to carry out. Adding lead-times for all activities involved in logistics makes up the total lead-time from when an order is placed until the customer receives and pays for the product.

It has been recognized by several authors (Abrahamsson and Brege 1995, Christopher 1992, Persson 1992) that time management is one of the most important aspects of today's competition. "Time is money" is the axiom, which complements the traditional view of logistics that costs are associated with *geographical distances*, with the notion that it is as much *time distances* that have to be bridged in a cost-efficient manner. Persson (1992) claims that the more successfully a company manages to reduce

[1] Ernst & Young Company presentation, Handelshögskolan, 9 November, 1999.

lead-times compared with competitors, in for example bringing a new product to the market, delivering products to customers etc, greater the chances are for a better competitive performance.

Abrahamsson (1992) argues that the fundamental benefits for companies that reduce lead-times are two-folded: cost rationalization and better scopes for market-orientation. Cost rationalization may take place as companies restructure the logistics system through decreasing the number of warehouses and instead establish one central warehouse in which products for a larger market are stored. As such, capital tied up in buildings and inventories, as well as variable costs of salaries and administration, can be reduced compared to the case of inventories held at several locations.

The market-orientation may also increase when a company focuses on reducing lead-times, since it requires that non-value adding activities must be eliminated. Abrahamsson claims that when companies manage lead-time reductions successfully, it leads to faster and more reliable deliveries to customers, and increased flexibility for customer requirements, and it is easier to have inventory controls. As there is normally a vast variety of supplier options, the company that can deliver a product faster and more reliable than competitors has a better chance of becoming the customer's first choice.

Since scopes for cost rationalization and increased sales revenues prevail when lead-times are reduced, the link between profitability and lead-time is apparent. Persson and Virum (1996) add that reduced lead-times lead to improved productivity, quality, innovation, and reduced inventory levels. It enhances internal efficiency and improves customer satisfaction since it forces companies to develop more rational and efficient systems. By directly focusing on time, companies are usually benefiting from shorter cycle time and faster inventory turns.

2.4 Order-to-payment process: a fad or a useful concept?

An area that has gained substantial interest during the late 1990s in terms of lead-time management is the order-to-payment (OTP) process. The OTP process regards all activities taking place between a supplier and customer when an order is placed. There are, according to Hoover et al (1996), three different logistical flows involved in the OTP process: products, information, and monetary flows. For illustration see figure 2.3.

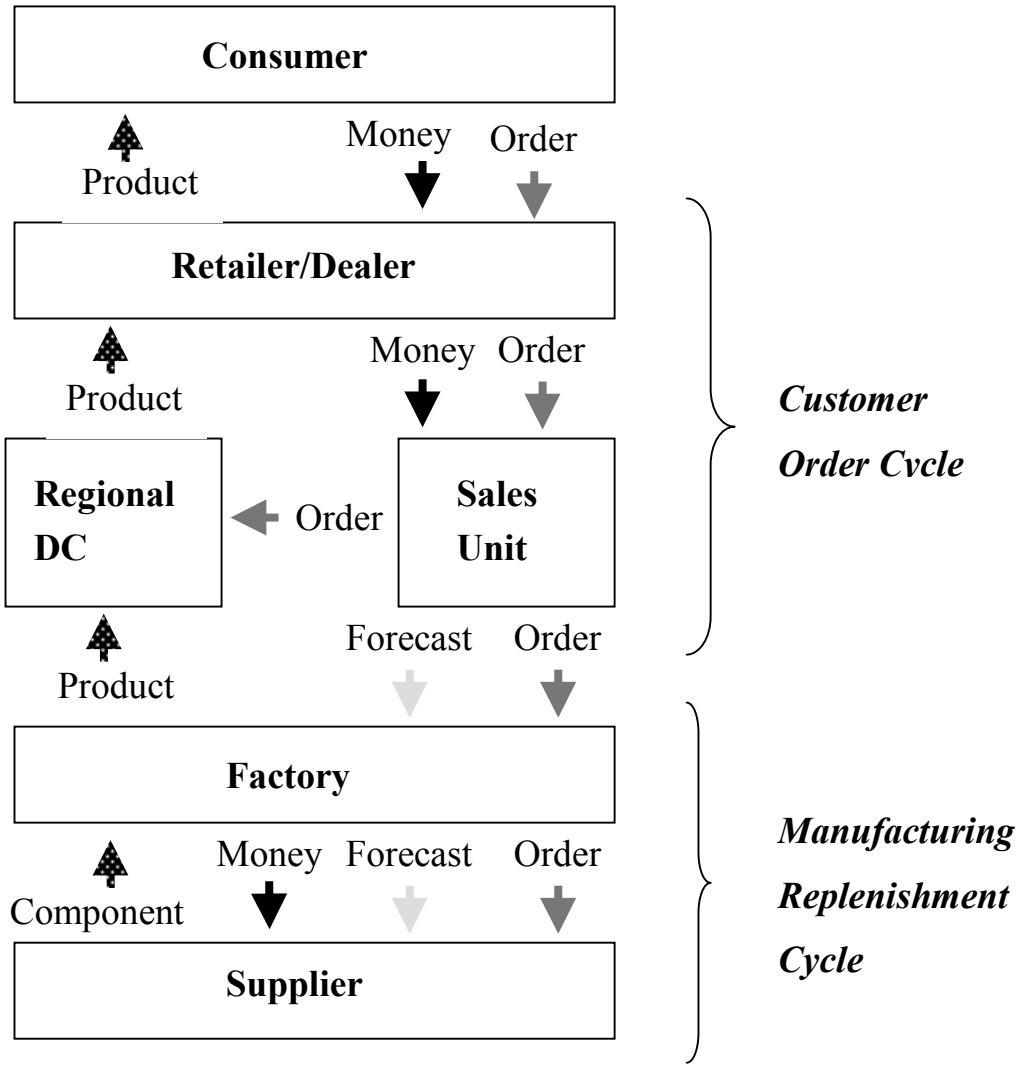


Figure 2.3 The order-to-payment process
Source: Hoover et al (1996)

The product flow starts when a company orders components or raw materials. It then passes the manufacturing processes to become a finished product, which is distributed to the end-customer. An accurate information flow is crucial to make correct sales forecasts and supply excellent service to customers. Collecting the right information can also provide a company with better knowledge of which products to serve to which segments. The monetary flow is included to complete the sequence of the process.

According to Persson (1992), as much as 95% of the time of a company's total OTP process is not benefiting the customer in any sense. The ambition should not be focused on carrying out activities faster than before, but rather on restructuring the different set of processes involved of the OTP process in order to create as much value in each lead-time process.

Having a process-perspective when evaluating the logistics performance of a company facilitates the identification of reasons for shortcomings in the logistics system. Hoover et al (1996) argue that companies that suffer from underperformance, such as low delivery reliability, stock outs and long lead times, need to examine how the OTP-flows are managed. Other symptoms can be high inventory levels or poor and inflexible systems which make it more difficult to adapt to changes in the market.

What makes the concept of OTP interesting is that it not only considers the product and information flow like conventional logistics theories, but also includes the monetary flow. It is also a wider process-cycle concept than, for example, the order-to-delivery (OTD) process concept, which other authors like Christopher (1992) and Gattorna and Walter (1996) advocate. We would argue that the concept of OTP is a broader and more useful one, since it includes the monetary flow and does not stop until the products have been paid, as opposed to delivered.

2.5 Product flow

Examining the distribution of physical products, from the production site to end-customer, involves an investigation of three important factors: transportation, warehousing, and inventory management.

2.5.1 Transportation options

Transportation usually represents the most important single element in logistics costs for companies. According to Ballou (1999), freight movement represents some 30-60% of total logistics costs, and therefore requires a deep understanding of the logistics responsible. Transportation of physical products can be conducted in four different manners: road, rail, water, and air. They can either be used separately or in combination, and with the support from different transportation agencies, freight forwarders or brokers.

Road transport

The use of trucks has increased significantly over the last decades in almost every part of the world (Lumsden 1998). A similar expansion is, however, not likely to occur in the future, since the nature of roads regarding durability, width and traffic security does not allow transports of cargo at unlimited sizes or weights. Within the EU, for example, lorries are not allowed to exceed a total weight of 60 tons and 2.4 meters of width. It is, however, the most flexible way of transportation since the route can be customized.

Rail transport

The railroad is normally used for moving products with a low necessity for fast transportation. The reason for the low speed of the freight car is partly the great weight of the vehicle and cargo, partly because most time is spent on loading and unloading goods.

Sea and air transport

Intercontinental transports are mostly conducted by sea or air. Deciding which transport alternative to use is to a large extent influenced by making trade-offs in three different dimensions, which is illustrated in table 2.3.

Because of the nature of our case company, i.e. a provider of heavy equipment, it means that the use of air transportation is very seldom used when transporting to other continents. We will therefore take a closer look at different vessel types.

Horizontal trade-off	Comparison of performance and cost between Sea vs. Air transportation.
Vertical trade-off	Comparison of performance and cost between Air alternative I vs. Air alternative II. Sea alternative I vs. Sea alternative II
Lateral trade-off	Total cost perspective – weighing transport cost vs. cost consequences in another area of the logistics chain. For example, increased costs of fast transportations may reduce the need for having an inventory, thereby reducing inventory costs.

Table 2.3 Transportation trade-offs
Source: Ballou (1990)

Lumsden (1998) classifies transportation vessels of physical products into two main categories of ships:

- Lo-Lo ships (Lift on lift off) are characterized by having their cargo lifted onboard with cranes, which is the case with container ships.

- Ro-Ro ships (Roll on roll off) are having their cargo loaded horizontally, i.e. the freight rolls on and off the vessel by its own engines. The Ro-Ro ship is the most efficient ship type regarding load time of cargo. It can normally transport all kinds of goods, such as cars, heavy trucks and railway wagons. One particular kind of Ro-Ro ship is the car carrier, which was originally designed for car-transfer purposes only but has lately been equipped with space for conventional Ro-Ro cargo.

2.5.2 Warehousing

A warehouse is the physical mode where inventories of materials and goods are held for varying periods of time. It has been the most important tool to create proximity to customers and to reduce the lead-time for product delivery to reach the final destination (Ballou 1990). Companies have traditionally kept high inventories of goods which are often spread on several warehouses in order to have security buffer to changed customer demands, and able to promote themselves as truly customer oriented.

Warehouse decisions

Ballou (1990) claims that the basic warehousing decisions to take into consideration are ownership, number of facilities, size, and location. Companies that have a substantial amount of output normally choose to own their warehouse. In that way, the fixed costs of the warehouse, e.g. property tax and depreciations, can be spread over the product volume and therefore represent a relatively low unit cost. The other alternative, which is more interesting to companies with lower output volumes, is a public or third party warehouse. Cost and service levels do vary in such warehouses, but in general the costs are strictly variable and therefore they constitute an interesting alternative for a low-volume company.

The number of warehouses a company should have depends on several factors. Ballou argues that the company size, the demand and supply

situation, as well as the competitive situation are the most important factors. It is also important to weigh the warehouse solution against available transportation alternatives. The size of the warehouse is also to be coordinated with the amount of warehouses.

One key aspect of warehouse and inventory strategy is the question of where the warehouse is to be located. There are several different methods in use for appraising where a warehouse most ideally should be located. Ballou (1999) gives the example of one popular and rather simple method called the "Exact center-of-gravity" approach, which is a mathematic model that only takes a limited amount of factors into consideration. In general terms, its basic purpose is to calculate the total cost for a given level of unit volume located at a specific point, multiplied by the transportation rate to that point multiplied by the distance to served markets from that point. Calculating and comparing the total costs for different geographical locations can identify the least expensive alternative of warehouse location. For a more detailed examination of the formula see Ballou (1999).

A survey in the *Transportation and Distribution magazine* (in Ballou 1999) presented what manufacturing companies ranked as the most important factors when choosing a warehouse location. This is illustrated in table 2.4.

Warehouse strategies – a matter of decentralization/centralization

The role of warehousing has developed and expanded over time. Persson and Virum (1996) hold that the options of how to use a warehouse have increased substantially during the last decade. These options can be seen from two main perspectives, namely how many warehouses the company has, and what level of value-adding activities that takes place in the warehouse. The trend today is to have as few warehouses as possible and to undertake value-adding activities to the largest extent possible, i.e. centralizing warehouse activities to one site per market. There are, however, different solutions for different companies.

1. Transportation access	2. Outbound logistics
3. Customer proximity	4. Inbound logistics
5. Labor availability	6. Labor costs
7. Union environment	8. Taxes
9. Just-in-time requirement	10. State incentives/laws

Table 2.4 Most important factors for warehouse location
Source: Ballou (1999)

Five solutions are presented in figure 2.4 – 2.8. In figure 2.4 the products are distributed directly from the producers via agents to the market, which is the case in direct export. In that way, the company eliminates costs of warehousing but has on the other hand little control of further distribution to markets.

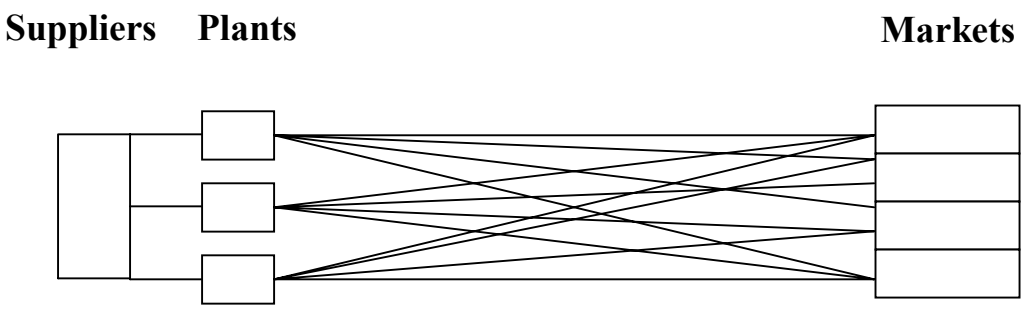


Figure 2.4 Direct export
Source: Persson and Virum (1996)

Some companies take advantage of national warehousing where gross inventories are stored (illustrated in figure 2.5). This is a suitable solution

when sales reach a relatively high level. It increases the control of distribution, but at the same time problems arise, for example how to coordinate different national warehouses.

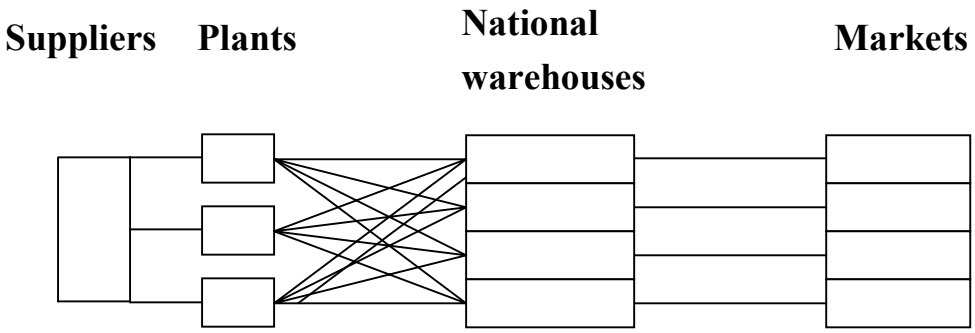


Figure 2.5 National gross inventories
Source: Persson and Virum (1996)

Having a "gateway" warehouse is an appropriate solution for companies that want to have a central warehouse for supporting a region together with national inventories (see figure 2.6). Logistics costs are often reduced and products can be delivered faster.

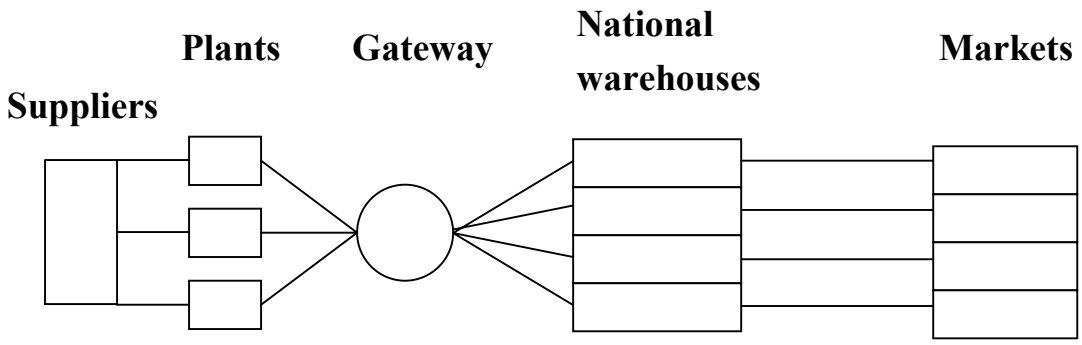


Figure 2.6 Gateway warehouse
Source: Persson and Virum (1996)

An increasingly centralized warehouse solution is the distribution-center concept (see figure 2.7). Companies may set up a distribution center from which products are distributed directly to individual markets in a region.

Compared with the Gateway warehouse, this solution eliminates national warehouses and consequently the costs associated with them. However, it requires sophisticated organizational solutions in order to be efficient.

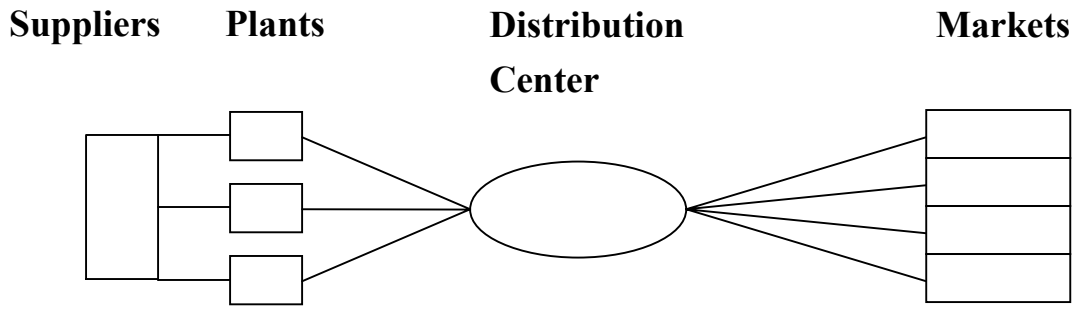


Figure 2.7 Distribution Center
Source: Persson and Virum (1996)

The most centralized solution of how to organize a warehouse is a development of the principle of distribution center (see figure 2.8).

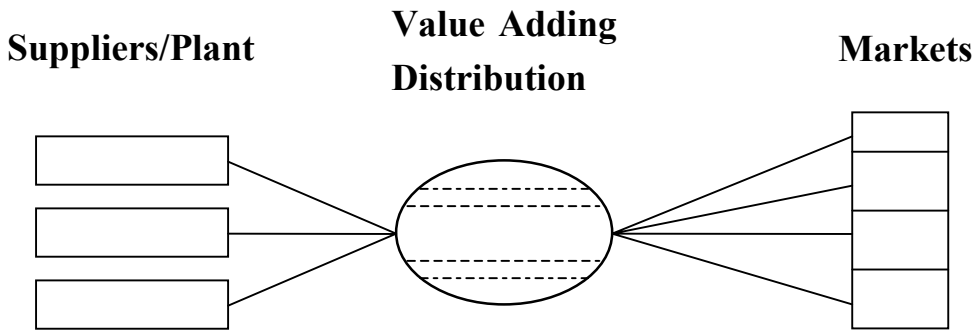


Figure 2.8 Value-adding Distribution Center
Source: Persson and Virum (1996)

Instead of only being a location where inventories are stored, companies gradually start to use the distribution center as an area where value-adding activities take place, e.g. repacking or local adaptations of products for

certain markets. The cost-efficiency and customer flexibility increase, but it may also mean that the new role of the distribution center requires a new organization. Outsourcing of production is one possible outcome as the role of the warehouse grows in importance.

2.5.3 Inventory

Inventory is a logistical activity associated with a high proportion of a company's total logistical costs. Seen from a product-flow perspective, inventory has been referred to as "transportation at zero miles per hour" (Ballou 1990). The primary purpose of carrying inventory is, according to Persson and Virum (1996), to be able to fulfill a set level of deliveries to customers. Since a supplier cannot calculate an exact customer demand in advance, nor provide customers instantaneously with the demanded product, inventory is for many companies a feasible solution.

Coyle et al (1992) support the notion that companies benefit in different aspects when inventories are held. They argue that transportation savings can be made if accumulated finished goods are transported in large and few shipments instead of many shipments with low transport volume. Customer service is also one key factor for companies to carry stock since product availability increases customer satisfaction when orders are placed. Having an inventory also reduces costs of lost sales. Competing on a market characterized by a high degree of product substitutability may urge companies to have sufficient inventory levels over time.

However, the view that companies should carry inventory has changed radically within the last three decades. From being perceived as a sign of prosperity and a high level of delivery security it is today more viewed as a cost factor which needs to be reduced to the largest possible extent, according to Persson and Virum (1996). As a consequence, both numbers of inventory storages and its function have been centralized.

Gattorna and Walters (1996) have identified four direct inventory costs. The largest direct cost is the capital cost of holding an inventory. Since the capital tied up in a product could have been generating interest rate, there is an opportunity cost of holding an inventory. The second cost associated with inventory is the cost of storage space. Examples of this are the facilities were the products are manufactured and warehousing. With holding an inventory also comes the cost of insurances. Lastly, the costs of risks associated with holding an inventory must be considered. Products can be damaged and if they do not sell they become obsolete.

Three indirect costs are also associated with holding an inventory. The most obvious one is the business risk. A company can risk holding insufficient inventory, thus being unable to satisfy customer demand. Of course, the opposite, of holding too much inventory, may satisfy demand, but will increase direct costs. If a company has limited capital, holding an inventory may induce an opportunity cost because of a lack of capital to invest in other alternatives. Finally, holding too much inventory adds indirect costs by the incremental increase in infrastructure costs.

2.6 Information flow

The importance of information has increased significantly during the last ten years. Gattorna and Walters (1996) describe the 1970's and 1980's as a time when information was viewed as a necessity for the distribution system to run smoothly. Today, information is the core of logistics activities. The main reason for this is the breakthrough in information technology, which has enabled companies to deal with larger amounts of information, in a more integrated way at a much lower cost than before. However, much of the information flowing through a company does not run through a computer system. Most of the information is actually shared between individuals.

2.6.1 Strategic and operational information

According to Gattorna and Walters (1996), the information from the OTP cycle generates different requirements for three levels of management. At the board level, where planning and control are executed, the information requirement is mainly focused on market development forecasts, customer service requirements, return on investment profiles and system capabilities. The board needs information about how well the business is performing and generating a satisfactory return for shareholders. Furthermore, information regarding future developments in the market that provide future investment decisions is desirable.

At the next level, more detailed information is required from the functional directors and senior operation management. Information about current system capacity and capability is needed as well as the current performance in the marketplace. The interest here is to make sure that the logistical system is used in the most effective way at the budgetary cost. Volume and market share as well as margins need to be known at this level. Finally, at the supervisory level, information regarding customer service achievements and sales volume performance is needed. The information generated at this level focuses on matters such as order cycle time, availability, orders satisfied and segment sales.

2.6.2 Customer order processing information

During the time from when a customer places an order until the product is paid, much information is generated. Gattorna and Walters (1996) have divided up the process in six steps (see figure 2.9).

The communication systems act as a linkage within the supply chain that identifies product needs and locations and finally direct the product flow to ensure customer satisfaction. This implies that the flow of information must be relevant and accurate.

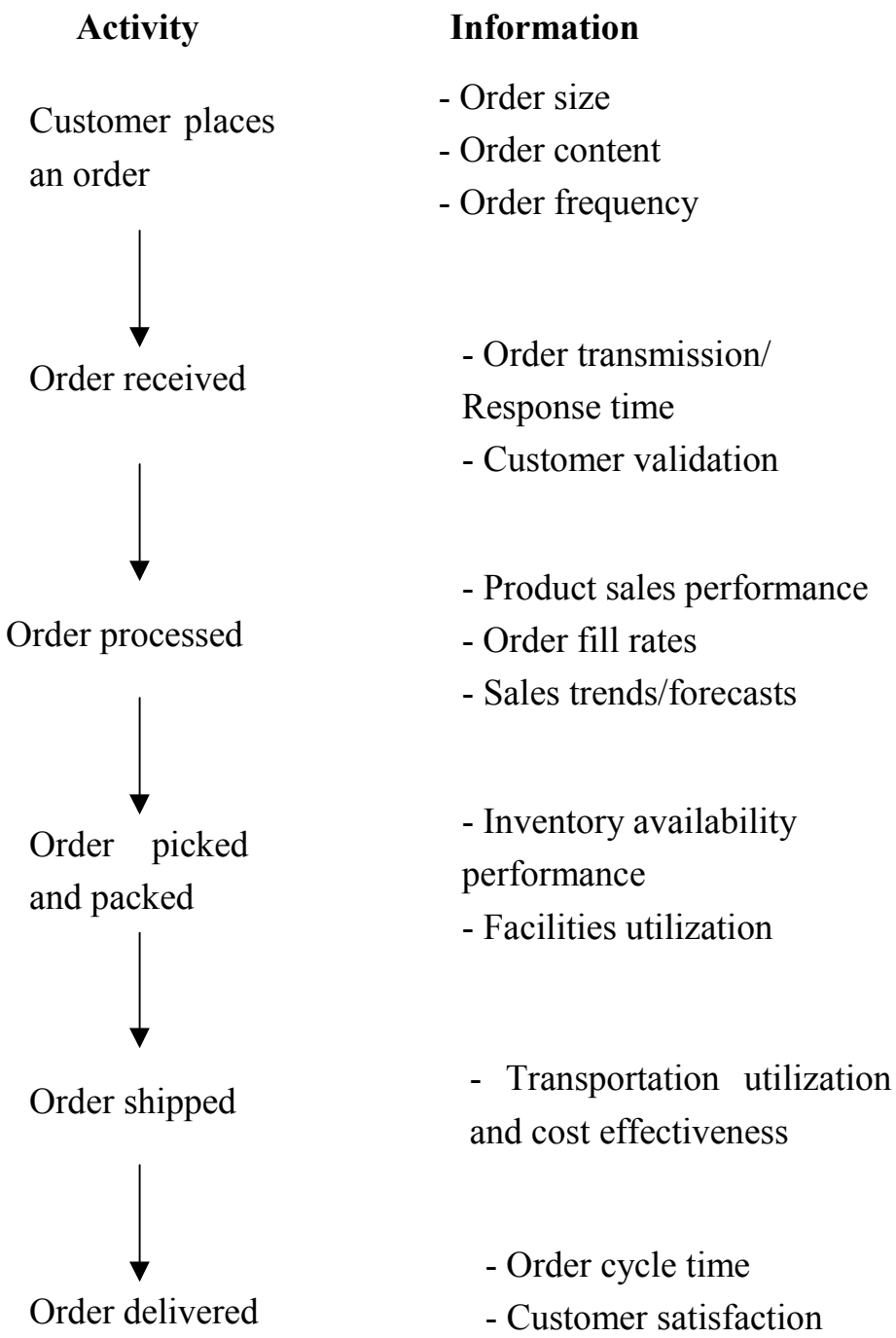


Figure 2.9 Information generation in the order to delivery process
Source: Gattorna and Walters (1996)

2.6.3 Forecasting

One of the most important information flows to monitor in the supply chain is the data generated for future sales. Nahimas (1997) argues that all business planning is to some extent based on a forecast. Sales of existing products, customer demand patterns for new products, needs and availability of raw materials, changing skills of workers, interest rates, capacity requirements and inventory levels are all examples of areas that are affected by forecasting. In a company, forecasting methods are mainly used in the functional areas of marketing and production. Since forecasting triggers other mechanisms, such as inventory planning, production planning and procurement, the ability to calculate future demand is very important.

However, forecasting is not easy since demand is often volatile. Predicting what will happen in the future is an art that calls for experience and good knowledge of the business. Schary and Skjött-Larsen (1995) argue that forecasting becomes even more complex in international companies. Since data is retrieved from different countries with different business practices, customs and other external factors, data must be interpreted and converted to be useful. In a company with multiple organizations, these issues make the forecasting process even more uncertain.

Recently, researchers (see for example Abrahamsson and Brege 1995) have argued for less forecasting since it is mostly wrong. Instead a company should focus on a more flexible production method that reduces the importance of making correct forecasts. The manufacturing facilities should be flexible enough to produce on order.

Forecasting methods

Nahimas (1997) makes the distinction between subjective and objective forecasting methods. A subjective method is based on human judgment. According to Nahimas the four most common subjective techniques are

sales force composites, customer surveys, jury of executive opinion and the Delphi method.
Sales force composites is the most common form where sales people estimates are aggregated into forecasts. Customer surveys usually signal future trends and shifting customer patterns. By combining information from experts, a forecast can be made. A jury of executive opinion or the Delphi method could do this. The difference between the methods is how individual opinions are combined.

Objective forecasting techniques, on the other hand, use a more statistical and mathematical approach for creating a forecast. The two most common ones are causal models and time series. A casual model uses data from sources other than the series being predicted. This could be data that is linked in some way to what is being forecast. A time series method, on the other hand, uses only past values of what is being forecast, for example sales.

Gattorna and Walters (1996) add to these methods the point of sale data systems (EPOS or ECR), which link the manufacturer with the buyer. These systems, mainly used in the retail industry, track every sold item and send the information to the manufacturer immediately after the product is sold. This way the manufacturer receives an early warning if sales are increasing or decreasing. Consequently, the manufacturer will be able to shift the production to match the current demand.

2.6.4 Logistics information systems

The interest and investments in logistics information systems are currently booming. In the beginning, retailers and vendors were early to adopt these systems, which gave them substantial benefits. Applications like electronic data interchange (EDI) and efficient consumer response (ECR) have provided vendors with a solution to deliver merchandise on a just-in-time basis to retailers. A significant reduction in inventory and labor costs has

been achieved. Now systems are also being developed for other industries, which can help, for example, industrial organizations to improve their business. The "buzzwords" these days are enterprise resource planning system (ERP), e-commerce solution and supply chain management software applications. An ERP system can reduce the financial reporting, purchasing, and support expenses of management information systems (MIS), leading to a more up to date analysis and reporting of sales, customer and cost data (Wagle 1998). The benefits of installing these systems are tremendous, but several reports have also pointed out the problem of achieving the bottom line impact (see for example KPMG study 1998, Wagle 1998, WERC study 1998).

Abrahamsson and Brege (1995) argue that modern information systems are a prerequisite to achieve time-efficient distribution. A proper information system solution provides scopes for administrative lead-time minimization. The total lead-time is constructed by an administrative and an operational part. The administrative part is made up of order receiving, registration, order picking, documentation and invoicing. As this part accounts for in some cases up to 90% of the lead-time, scopes for vast lead-time reduction prevail within this field, according to Abrahamsson and Brege.

2.7 Monetary flow

In international transactions, the monetary flows become more important since the risks involved are much greater than in domestic transactions. This section will deal with three issues: international transactions, foreign exchange risks and transfer prices.

2.7.1 International transactions

For companies trading in foreign countries where the judicial system might not give the proper protection or where companies do not trust each other's capabilities of fulfilling agreements, there is a need for a secure transaction. To cope with this problem, three financial devices have been created: the

letter of credit, the draft (or bill of exchange), and the bill of lading (Hill 1998). Together with a third party – normally a bank – the companies can exchange money and merchandise.

The letter of credit (L/C) is a statement saying that a bank will pay a specified sum of money to a beneficiary, normally the exporter, on presentation of certain documents. A draft or the bill of exchange is the instrument used to affect the payment. It is a written statement by the exporter instructing the importer to pay a certain amount of money at a specified date. Finally, the bill of lading (B/L) is the last document needed to make the transaction. This document is issued to the exporter by the common carrier transporting the merchandise. The B/L serves three purposes: it is a receipt, a contract, and a document of title. To understand how an international transaction is carried out, consider study appendix 3.

2.7.2 Foreign exchange risks

The risks involved in dealing with foreign currencies can be divided into three types, according to Valdez (1997):

- Transaction risk
- Translation risk
- Economic risk

The most common risk in international business today is the transaction risk. Valdez (1997) takes the example of a German importer that needs to pay in USD in 6 months for products ordered today. If the DEM weakens against the USD, the imports will cost more. The opposite may also be applied, namely that the exporting U.S. Company ships the products to Germany, but as the products arrive, the USD has strengthened against the DEM, making the earnings less. To avoid this kind of risk, companies engage themselves in hedging or forward exchange.

A forward exchange is an agreement between two parties, normally a bank and a company, to exchange currencies at specific dates in the future. To ensure that the company will receive approximately the same amount of money when the deal is done, they pay either a premium, if the exchange rate is likely to appreciate, or they buy at a discount if the currency is likely to depreciate. In this way, the company can reduce the risk of dealing with different countries.

The second risk, the translation risk, deals with issues arising when for example a Swedish subsidiary reports profits to an English head office in SEK. The Swedish subsidiary also owns land and property. If the krona weakens against the GBP the profits are worth less in British sterling. The value of land and property may be unchanged, but the sterling value seems to have lost value. Since this is not closely related to logistics, we will not discuss it further.

Lastly, the economic risk involved in competing in other countries is to be considered. Take for example a Japanese company competing in France against an American company. If the USD weakens against the JPY, the Japanese company will be faced with a competitive disadvantage, since their prices will be relatively higher than those of the American company. The way to secure a company against this type of risk is to spread the company activities to different countries, and thereby reduce the risk of being too dependent on one single currency.

2.7.3 Transfer prices

A large part of the transactions that takes place in the world economy is between different units within a company. The prices that are set for these products or services are usually referred to as transfer prices. How these transfer prices are set is determined by the goals and organizational structure that a company has, as well as the regulatory environment in which the company operates (Crow and Sauls 1994). Since transfer prices

can be used to position funds within an MNC there are some advantages to be gained (Hill 1998). A company can, for instance, set high transfer prices in one country to avoid high taxation, whilst setting lower transfer prices in another country where the tax structure is more favorable. High transfer prices can also be used for reducing exposure to foreign exchange risks. On the other hand low transfer prices are favorable when importing goods into a country with high import duties.

However, transfer prices also pose problems. Companies working with a JIT philosophy will experience problems if the transfer price is not set at the national "business unit" level. Otherwise concepts like efficiency, quality and timeliness may not be relevant since they motivate company sub-levels to optimize their activities at the expense of global optimization, according to Bolander et al (1999). Furthermore, if the manufacturing unit acts as a profit center, where a profit margin is added to every unit sold to the distributing unit, the cost of inventory at distribution level will increase. Thus, the distribution unit will be less inclined to hold an inventory (Bolander et al 1999). A profit center is an organizational unit charged with a well-defined mission and is lead by a manager accountable for the center's revenues and expenditures, according to Wright et al (1996).

2.8 Conceptual discussion

We believe it is important to state how we perceive the concepts of "supply chain management" and "logistics" since they in many aspects resemble each other. The traditional view on logistics is that materials management and physical distribution are the corner stones, through which companies try to create as efficient flows of products and information as possible. They tend to be seen from the individual company's perspective and not integrate external stakeholders to the extent as is done in the perception of supply chain management. Since we are examining the area of physical distribution, i.e. from the moment a physical product is manufactured/ assembled until it is delivered to its final destination, we have to include

externally related actors, because our case company does not perform all distribution activities alone. From a process perspective we do not perceive boundaries between companies involved in such flows as distinct as is the case in the traditional view on logistics. We therefore conduct research in an area of logistics with a strong influence of supply chain management philosophies.

The concept of supply chain management is also used in a variety of ways by different authors. Some use it to describe the internal activities within a company; others extend it to involve other companies. To avoid such confusion when talking about supply chains, we will use the term 'internal supply chain' when we talk about activities conducted within the company. The term 'external supply chain' will be used when we talk about activities that directly include other companies.

In reviewing current literature we have found that there is a close relationship between profitability, competitive advantage, logistics and lead-time. These four are closely interrelated (see figure 2.10).

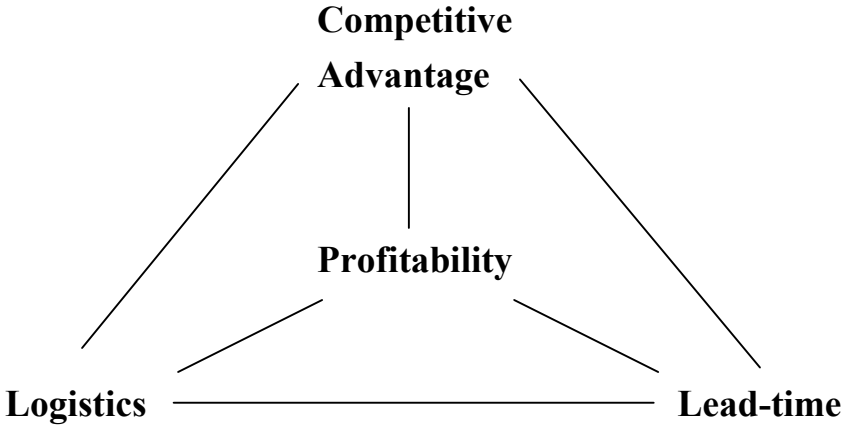


Figure 2.10 The triangle relation
Source: Our own

Firstly, we identified a relationship between competitive advantage and profitability. Then followed a discussion of the relationship between logistics and profitability. Finally, we showed that reducing lead-time is related to profitability. Thus, there is a strong relationship between competitive advantage, logistics and lead-time.

We have found that the focus in current literature is mostly on improvements in the retailing industry. The same can be said about theories and models discussing international issues. There is a clear lack of theories regarding logistics for international companies that market bulky and heavy products on distant markets. However, some of the theories are applicable to industrial companies, but it is important to understand the origin of the theories.

3. METHODOLOGY

The purpose of having a methodology description is to explain and justify how we have progressed in our research. It also gives an idea of how the work proceeded and why we chose to do as we did and in what way. We will start by describing our research strategy and method. How we collected and analyzed the data will follow. Finally, we will discuss the quality of the methods we chose.

3.1 Research Strategy

According to Yin (1994), there are basically five research strategies: experiment, survey, archival analysis, history and case study. We have chosen the case study as our research strategy. Merriam (1998) suggests that the case study is designed to gain an in-depth understanding of the situation and meaning for those involved. The interest is in the process rather than the outcomes, in context rather than specific variables, in discovery rather than confirmation. Compared to other qualitative research methods, case studies are intensive descriptions and analyses of a single unit or bound system. Yin (1994) has given the following description of a case study:

"In brief, the case study allows an investigation to retain the holistic and meaningful characteristics of real-life events – such as individual life cycles, organizational and managerial processes, neighborhood change, international relations and the maturation of industries." (Yin, 1994 page 3)

However, the case study method has its opponents. Yin (1994) has compiled the three most common prejudices against case studies. The most common one is that a case study lacks rigorous research, implying that the

researcher has too biased views which may influence the findings and conclusions. A second concern is that a case study does not provide enough material to make scientific generalizations. The third complaint about case studies is that they take much time.

We chose to use the case study method since it gives us a deeper understanding and more holistic view of the studied research problem. We believe that the research problem is of a rather complex and multifaceted nature, making an in-depth analysis the most appropriate method by which to approach the problem. A case study approach also gives the best opportunity to understand how the different flows in the OTP process influence and affect a company.

In addition, this strategy can furthermore be divided into descriptive, exploratory and explanatory. Since our main purpose is to create a new theory on how the order-to-payment process supports a company's competitive edge in the heavy equipment industry when faced with long distance between manufacturing and markets, and to map the processes involved in the OTP process and discover ways of improvement, we have chosen the case study as our research strategy. This strategy is also suitable to use when the purpose is to discover something, i.e. when there is an exploratory purpose (Merriam 1998). After having studied current theories of logistics, we have discovered that the coverage of how to transport bulky products over long distances is to a large extent lacking. We are able to use the theories seen as relevant in combination with the empirical findings of a thorough case-company study in order to start the process of creating a new theory for companies in similar situations. Our purpose is also descriptive since we map the steps in an OTP process.

3.1.1 Choosing Volvo CE

The interest in the selected case company arose when we in the fall of 1998 wrote a report about the construction equipment industry focusing on

Volvo CE's competitive situation. During the spring, 1999, we initiated contact with Volvo CE and mutual interest for a thesis report occurred. We proposed to study a subject that was of strategic relevance for Volvo CE and they suggested that we would examine the logistics activities in SEA and Australia. The particularities of the products that Volvo CE manufactures, i.e. bulky, heavy and not easily transferred over longer distances, make such a study indeed relevant. Also, the fact that the markets to be examined are located at long distances from sites of production led to the conclusion that Volvo CE faces major logistical challenges. As mentioned in the problem background, logistics has become a major strategic issue for a majority of companies, and in particular for MNCs. The case study was conducted during the fall of 1999.

3.1.2 Case study design

Yin (1994) has identified four types of design for case studies. The distinction is made between single and multiple case studies, which reflects the number of cases studied, for example companies. The second distinction is made between cases that study a single unit (holistic) or multiple units (embedded) within a case. The distinction here concerns how many units within the case that are studied.

Since we are only studying one single company we have a single case design. Yin (1994) argues that this approach is relevant to use when the case is unique or represents a phenomenon not previously studied or when testing a theory. Since theories describing logistics conditions for bulky products where large distances between manufacturing and customers prevail are rare, we argue that our case study is unique. The question is whether it is a holistic or an embedded case. As Volvo CE comprises of several different entities spread over all the continents it is not possible to conduct a holistic case study. Instead, we are obliged to take an embedded approach, meaning that before attempts to generalize the result of the study

on other heavy-equipment companies can be made a generalization of the result must first be applied to the entire Volvo CE.

3.2 Research method

A study can be qualitative, quantitative or a combination of both. The qualitative method permits an evaluator to study selected issues in depth and in detail. According to Patton (1990), the qualitative method allows fieldwork that is not constrained by predetermined categories of analysis. It facilitates the compiling of in-depth information about a smaller number of people and cases. Therefore, it increases the understanding of the cases and situations studied. The major drawback with the qualitative approach is that it reduces possibilities of generalization (Patton 1990). However, some authors (see for example Alvesson and Sköldberg 1994, Merriam 1998) are of the opinion that generalizations from the case study can be made. Alvesson and Sköldberg argue that case study findings above all point to interesting areas of future research and to the fact that the level of generalizability increases when more studies are conducted in the examined area.

The quantitative approach, on the other hand, requires the use of standardized measures so that the varying perspectives and experiences of people can be fit into a limited number of predetermined response categories to which numbers are assigned. According to Patton (1990), it becomes possible to measure reactions of many respondents to a limited set of questions, thus facilitating comparison and statistical aggregation of the data. This means that a set of broad generalizable findings can be presented succinctly and parsimoniously.

Since we chose to conduct a case study, the qualitative method suits our research needs. This method gives opportunities to compile data, which reveals information of both objective and subjective nature. It enables us to obtain necessary in-depth data about the specific research area, which would not have been possible to obtain with a quantitative study.

3.3 Inductive, deductive and abductive

A distinction can be made between an inductive, deductive, and abductive study. According to Wiedersheim and Eriksson (1991), an inductive study is based on identifying and perceiving phenomena in the reality from which general theories are later developed. There are no theories about the specific topic upon which the researcher can rely. In a study with a deductive approach, the point of departure is to test an existing theory with a particular hypothesis. By conducting a logical deduction of the findings the theory is either confirmed or modified in line with the new conclusions.

An abductive approach is perceived by Alvesson and Sköldberg (1994) as the most frequently used approach in case studies. It is an approach that combines both inductive and deductive criteria in the sense that the point of departure is the empirical findings (inductive), which together with the inspiration from existing theories (deductive) form the basis for discovering certain hypothetical patterns. During the research process, the hypothetical patterns are adjusted and refined. The abduction method is suitable when the researchers are in search of a deeper understanding, according to Alvesson and Sköldberg. The difference between the three approaches is illustrated in figure 3.1.

We believe that the abductive method is the most suitable one for this study. There are no adequate theories on logistics and supply chain management for solving our research problem, since they are mostly based on studies on consumer- or easily- transferred goods. Since the products of the case company are bulky and complicated to transfer, we have been forced to develop our own theories based on our empirical findings. We have emphasized the implications of the long distances more than existing theories, since we have identified a close relationship with the problems of transportation. We have, however, used prevalent theories of logistics and competitive advantage when feasible, since basic fundamentals of logistics in many respects remain the same, regardless of the products involved.

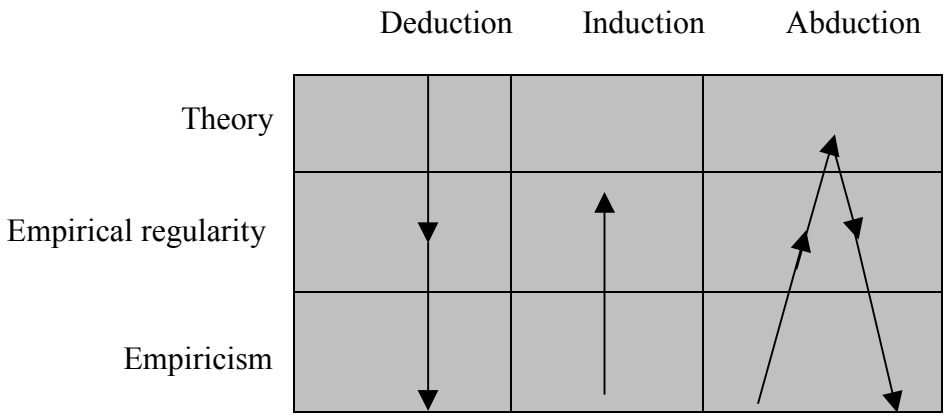


Figure 3.1 Differences between research approaches
Source: Alvesson and Sköldberg (1994)

3.4 Data collections

Basically, there are two kinds of data: primary and secondary data. Primary data is collected for fulfilling the needs of specific research. Primary data does not yet exist and must be collected. Secondary data is, on the other hand, previously published data not purposely collected for specific research. Secondary data can be found both within an organization and outside it. Common forms of secondary data include books, articles, company material, Internet sources, etc. Since collecting secondary data usually is the starting point in a thesis, we will start to describe our procedure for collecting that data.

3.4.1 Extensive collection of company material

To gain a pre-understanding of the situation Volvo CE is facing, we collected a substantial body of internal material, such as company reports, market studies made by Volvo CE and Equipment research group (ERG), business plans, and board meeting protocols. This material was aimed at Volvo CE top management. To deepen this understanding we also collected data from a variety of books, Internet web pages, and articles of various kinds.

3.4.2 Interviews conducted in three continents

Our main technique for collecting primary data has been through interviews. Merriam (1998) makes a distinction between highly structured, semi-structured and unstructured interviews. Highly structured interviews are done by questionnaires while unstructured interviews are more like conversations, with semi-structured interviews somewhere in between.

Almost all the interviews were taped. This has both advantages and disadvantages. The biggest advantage is that the researcher is able to collect much material. He/she will not miss any vital information that could easily be lost during an interview. Consequently, the researcher has more time to listen to the interviewees and produce follow-up questions for a later occasion. The disadvantage of using this approach is that interviewees might not reveal the whole truth and/or limit possible critique. By request of some of the interviewees, we decided not to reveal any sources, of information.

In the beginning of our research, some unstructured interviews were conducted to obtain an understanding of Volvo CE's situation and of the heavy equipment industry. A problem area was created, and more structured interviews were held. We would describe these as semi-structured interviews. To get a pre-understanding of Volvo CE, five interviews were conducted at the Headquarters in Brussels, Belgium. Open-ended questions as well as follow-up questions were posed leading to new areas of knowledge. In conjunction with Volvo CE, it was decided that interviews should be conducted at the Sales Companies in Australia and Singapore as well as the Product company in Eskilstuna.

A semi-structured interview was held with Arne Jensen, Professor of Transport and Logistics management at Göteborg School of Economics and Commercial Law, to discuss different ways of approaching the problem posed by Volvo CE.

All the following interviews were conducted in a semi-structured manner with open-ended answers. We started in Eskilstuna where we interviewed four managers. The intention was to get the Product company's view of the OTP process. In Australia, we interviewed five managers at the Sales company. At the same time, we were able to interview one manager from the Product company in South Korea and a representative for JFI customs, the freight forwarder in Australia. Interviews were also conducted with the Volvo CE dealer in Sydney, HBH Equipment, and one additional interview was conducted with two managers of the dealer CJD Equipment in Perth.

In Singapore, six interviews were conducted at the Sales company. In addition, a representative for the freight forwarder, Harbour Handlers, was interviewed. Finally, three managers representing the dealer Italthai were interviewed in Bangkok, Thailand.

Additional information was obtained from interviewing the Volvo CE key account manager at Volvo Transport in Göteborg. Four telephone interviews have also been conducted with a project manager at the Sales company in Germany, a market manager and finance manager at Product company in Braås and Eskilstuna, Sweden respectively, as well with a manager at the Brussels headquarters. Business information from the Product company in Canada has been received by e-mail. Numerous e-mails have also been made to collect additional information and verify collected material.

3.5 Data analysis

According to Merriam (1998), there are several levels of data analysis in a qualitative case study. The first step is to organize the data in chronological or in topical order and present it in a descriptive manner. The next step is to try to classify the data into some sort of categories, themes or types. Finally, the last step of analysis involves making inferences, developing models or generating a theory.

The first step of organizing the data was conducted during a workshop, which is described under heading 3.5.1. Simultaneously, an initial attempt was made at creating a relevant thesis structure. What we needed was a framework for arranging and analyzing the data. To be able to put the data into meaningful categories, we developed a model, inspired by Taylor's framework (1997) for analyzing logistical problems (see appendix 4), illustrated in figure 3.2.

In order to develop a deeper understanding of the competitive situation Volvo CE is facing in SEA and Australia, we made an industry analysis. For this analysis we used both secondary and primary data. After classifying the data into categories, we started to generate and evaluate alternative solutions. From the analysis we made some conclusions that were based on theoretical and empirical findings, which resulted in a model showing how OTP management supports competitive advantage. Finally, a number of recommendations for Volvo CE were made.

3.5.1 Work shop in Singapore

After the data had been collected during the round trip in Australia and Singapore, a workshop was held during the 15th and 16th of October in Singapore. The participants were our two tutors, a representative from Volvo CE, and the eight students participating in the project for Volvo CE. The purpose of the workshop was to compile and analyze the data that had been collected so far.

The starting point of the workshop was to present the most relevant data that had been collected in Australia and Singapore. This was kind of a brainstorm session where the most interesting problems were to be identified, and later presented. What followed was a continuous process. We had to present and revise our structure for presenting and analyzing the case several times.

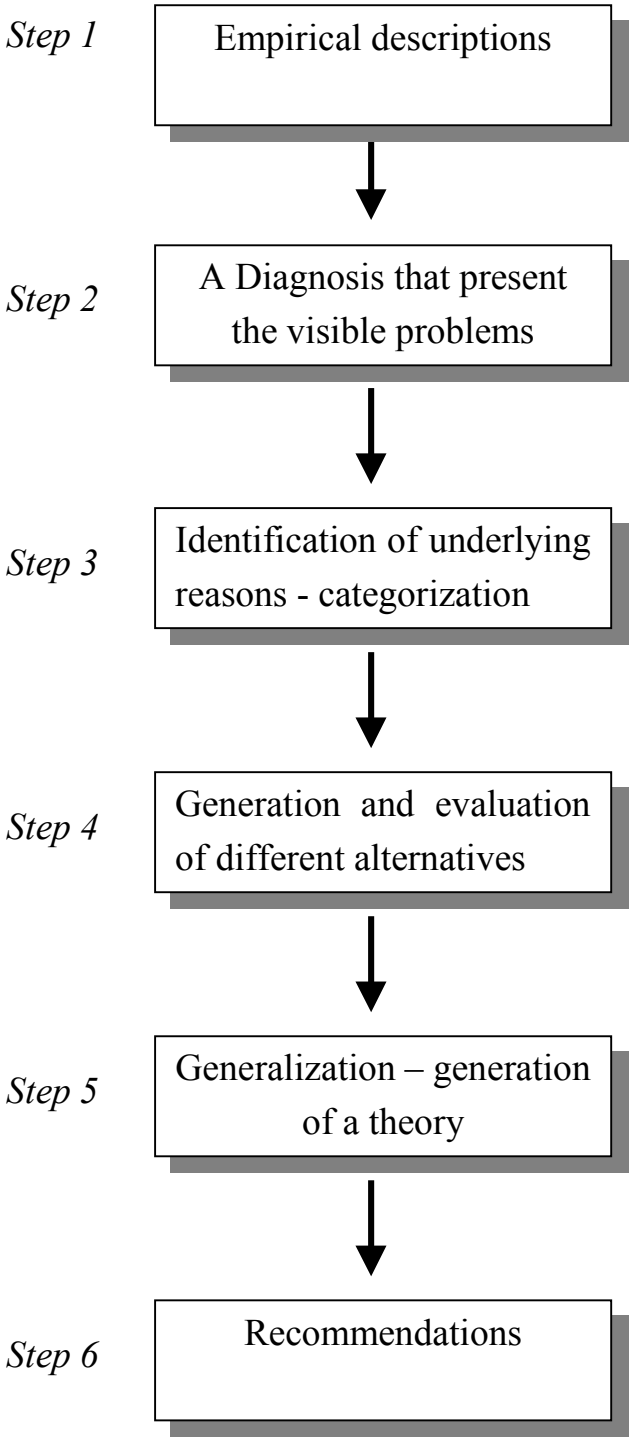


Figure 3.2 Framework for analyzing the data

While revising our outline, we received some guidance from our tutors and got some material confirmed by the Volvo CE representative. The outcome

of the workshop was that we had analyzed the material to such an extent that we could decide on a relevant structure for the thesis.

3.6 A perfect methodology?

A prerequisite for conducting scientific research is making sure that the used research method offers good quality, so that valid and reliable results can be presented. The researcher must do his/her utmost to ensure that the best scientific methods are being applied and that the reader is convinced of this.

The two most common ways of discussing quality of research are in terms of validity and reliability. In the most basic terms, validity is a measure of how well an instrument is really measuring what it is supposed to measure. For a quantitative study, the validity can be measured through calculations. In the qualitative study validity cannot be measured exactly but rather be discussed in terms of how well the theoretical framework is related to the empirical findings. Reliability, on the other hand, is a measure of to what degree a study repeated a second time would find the same results. Merriam (1998) has developed this further and divided the concept into three categories: internal validity, external validity and reliability.

3.6.1 A measure of reality

Basically, internal validity is a measure of how well the research findings match reality. The findings may be of a multiple nature. The creation of a new theory is one subject for internal validity examination since it is a constructed and simplified picture of the empirical findings. Another factor, upon which internal validity may be evaluated, is to what extent the examined problem in reality was a problem for the case company. We have decided to focus on how well our theory fits reality since it is a study of an area where little research has been conducted.

Since a researcher could be using subjective rather than objective judgments to allocate the data, the case study method has been questioned whether it fulfills the requirements for internal validity. To improve the internal validity Merriam (1998) suggests, for example, that a researcher should use multiple sources, ask respondents if the data and interpretations collected are the right ones, observe a phenomenon over a long period, ask colleagues to comment on findings, and clarify his/her assumptions.

We believe that we have conducted a study with high internal validity. We have interviewed 35 people with different professional insights in our research field. Since we visited the locations of the interviewee sites, sometimes for several days, we were able to inter-relate with respondents on several occasions for follow-up questionings. The personal interviews were taped, and when they gave conflicting information, we used the opportunity to verify the information with the respondents until satisfactory results were achieved. We have in some cases asked the interviewees to confirm the edited material in order to see to it that information was correctly interpreted. To collect more sensitive information, we had to turn the tape recorder off once in a while.

Throughout the research process we have had a high involvement from both academic tutors and representatives from Volvo CE, which we believe is another important factor that strengthens the internal validity of the study.

As earlier mentioned, we have based our research on existing theories where appropriate. This, in combination with the empirical findings, forms the basis for creating a model of how a company can enhance competitiveness by more efficiently handling its order-to-payment process under the conditions we have presented. However, the internal validity would have been higher if other studies had been conducted within our research area before.

Possible types of errors in case studies

There are several types of errors that may occur when a case study is conducted. The potential sources of errors are illustrated in figure 3.3. One type of error that may occur is having a wrong thesis purpose. The direction and content of the investigation, irrelevant information search, inappropriate questions, inadequate interviews, and errors in working and interpretation of information will occur. Having an incorrect or incomplete purpose will lead to an incorrect result of the study since the purpose can arguably be seen as the heart of the study. According to Lekvall and Wahlbin (1993), an inappropriate limitation or using a research direction that does not fulfill the purpose may give the investigation skewed or misleading content. Consequently, the internal validity will in reality be non-existing, since the findings are not correctly conceptualized into new theories.

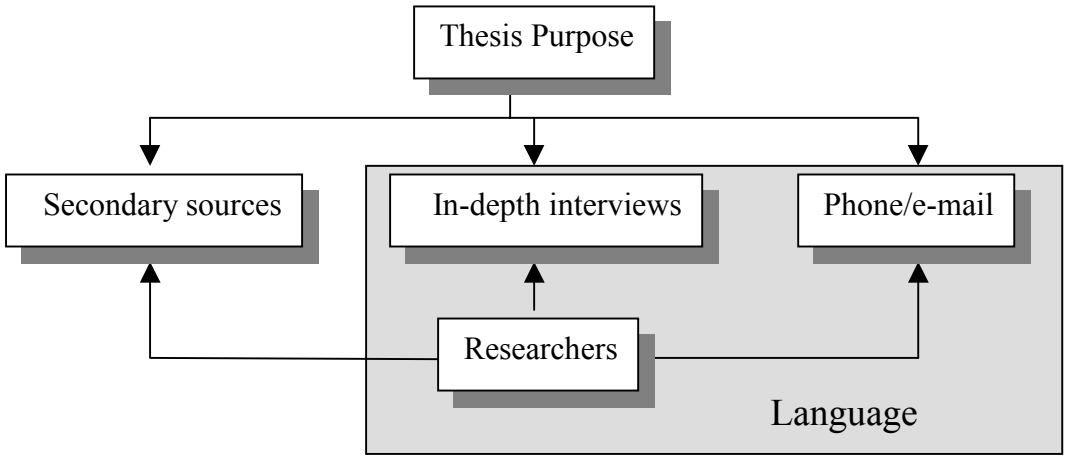


Figure 3.3 Possible errors in our thesis
Source: Our own

We believe that our thesis purpose corresponds to the investigated case. Our dedication to the purpose has increased, as we have understood that both academia and the case company may benefit from our study. The

purpose has also been decided and discussed for a long time, which has helped us to remain focused on relevant subjects.

Secondary sources may include a wide range of errors since the researcher has no control of the original information collection. Therefore, argue Lekvall and Wahlbin (1993), an evaluation of every source is important. We believe that we have used secondary information of high reliability. Apart from academic literature within logistics and supply chain management, we have mostly used material from Volvo CE and ERG, which is an independent body compiling information and statistics on the heavy equipment industry. Such information is the same as the top management of Volvo CE has used in their business analysis, which logically should be based on relevant and correct information. From this point of view our study has an internal validity since the information is available both in the form of raw data and data analysis.

Errors related to the in-depth/phone/e-mail interviews are mostly based on interviewer interference or that the interviewers ask leading questions. It may be the case that the interviewees are under time pressure, feel uncomfortable when the interview is taped or reluctant to respond honestly in order to protect either the company or his/her own actions. Some interviews have solely been made without meeting in person, which may increase the risks for misunderstanding or misinterpretations of questions.

However, we believe that we have reduced such errors since we have used the option on several occasions to pose questions again whenever they were unclear. Many of the in-depth interviews were conducted on sites where we had the opportunity to meet the respondents for several days. As earlier mentioned, all the interviews were taped. We have in some cases mailed back edited versions of the interviews for comments by the respondents. Thus, substantial efforts have been made to create a high validity and reliability of this study.

A majority of the interviews were conducted in English while a couple were made in Swedish. Even though as researchers we have been acquainted with the English language for many years, there are chances that we missed certain information due to language differences. In some cases we have conducted interviews with people of another mother tongue than English, which naturally reduces the chances of perfect communication. This is a factor that lowers the validity, but since most of time the communication has worked out very well, we believe that it is of minor importance to the validity of this thesis.

3.6.2 Can we generalize our findings?

External validity is concerned with the problem of knowing whether a study's findings are generalizable beyond the immediate case study. Merriam (1998) argues that for a case study to fulfill external validity it must offer a thick description, explain the typicality of the studied subject and use several cases. Also for a case study to be externally valid, the internal validity must be fulfilled.

We believe that our study fulfills the basic criteria for having a trustworthy level of external validity since we have focused on having a high internal validity. We have identified and described in a comprehensive way the challenges and problems that Volvo CE is facing when setting up an efficient logistics strategy on the SEA and Australian markets. In addition to giving a thick description of Volvo CE's situation, we have explained the typicality of transporting these types of machines. The lack of theories dealing with the problems facing heavy equipment manufacturers increases the typicality of the studied case. We argue that this increases the external validity of our study. Given the fact that several international companies dealing with heavy equipment are facing similar problems, we argue that our findings are also applicable to other companies within the heavy equipment industry facing similar problems with long distances between

manufacturing and markets, particularly where transportation possibilities are limited.

3.6.3 Reliable results?

Reliability is concerned with the extent to which research findings can be replicated. The goal is to ensure that a researcher follows exactly the same procedures described by an earlier researcher and conducts the same case study all over again, and that he/she would come to the same conclusions (Yin 1994). Merriam (1998) argues that this view does not fit qualitative research. Instead, the issue should be whether the results are consistent with the data collected. The researcher should explain the assumptions and theory behind a study, use triangulation, and explain how the data was collected and how categories were derived.

Depending on the capabilities of the researchers, the research result may vary in consistency with the data collected. We have, however, given thorough descriptions of the theory used, which together with our empirical findings form the basis for our own framework development. We have used inputs from many respondents at different positions within and outside Volvo CE, which have helped us to develop a holistic understanding of their particular situation. All interviews were taped and processed within short time spans. We have also described how our empirical evidence was compiled and how the data analysis led us to categorize the underlying problems responsible for the current performance of Volvo CE. We think this has increased the reliability of the study.

4. EMPIRICAL EVIDENCE

We will start this chapter by giving a presentation of Volvo CE, followed by a presentation of Volvo CE's activities in Southeast Asia and Australia. In addition, a short presentation of Volvo Transport will be made. However, the main part of this chapter is devoted to mapping the product, information and monetary flows within Volvo CE's order-to-payment process from the production sites in Sweden, South Korea and Canada to the examined markets.

4.1 Presentation of Volvo Construction Equipment

Volvo CE is one of the world-leading companies in the construction equipment industry.[2] It is a business division within the Volvo Group with approximately 9,700 employees and gross sales of MUSD 2.443 (1998). The product range comprises some 150 different models of Wheel loaders, Hydraulic excavators, Articulated haulers and Motor graders. The company has manufacturing facilities on four continents and has developed an independent distribution network, which is complemented by wholly owned marketing and sales companies in selected countries. The Volvo CE headquarters are located in Brussels, Belgium.

Volvo CE has development and manufacturing of Compact and Service equipment in two facilities for the global market. In Konz-Könen, Germany, the compact Wheel loader range of eight models is manufactured. The compact excavator line Pel-Job, consisting of 14 models, is manufactured in Belley, France. Application areas of compact Wheel loaders are lighter construction, service and maintenance work, whilst compact Hydraulic excavators are normally used for trenching and as tool carriers.

[2] This whole section is based on company presentation material and interviews.

Volvo Wheel loaders are developed in Eskilstuna and are manufactured at four different locations: Eskilstuna and Arvika product companies in Sweden manufacture seven models of small- and middle-sized Wheel loaders for the global markets. In Asheville North Carolina, U.S., the biggest Wheel loader model is manufactured for the global markets as well as four middle-sized models for the American market. Eight models of small-and middle sized Wheel loaders are manufactured in Pederneiras, Brazil, for the South American market. Five models of Samsung Wheel loaders are developed and manufactured in Changwon, South Korea. Wheel loaders are used in heavy primary production, excavation, load-and-carry tasks, and materials handling.

The six models of Articulated haulers are developed in Braås, Sweden, and manufactured at three locations: apart from Braås, manufacturing takes place in Asheville for the North American market and in Pederneiras for the South American market. Just recently Changwon started to manufacture one of the Articulated hauler models. Articulated haulers are used for moving large volumes of material without access to roads in earthmoving, quarrying, mining and waste handling applications.

Manufacturing of Samsung Hydraulic excavators takes place in Changwon. There are ten different models, both crawler and wheeled models. Wheeled Hydraulic excavators are also manufactured in Konz-Könen. Hydraulic excavators are used in construction, extraction and industrial applications.

Large production Motor graders are manufactured in twelve different models in Goderich, Canada, while the four-model range of small utility Motor graders is manufactured in Charlotte, U.S. Motor graders are primarily used for road construction and maintenance, site preparation and leveling, snow and ice removal, and haul road operations in forestry applications.

In Eskilstuna there are also the headquarters and plant of Volvo CE Components AB. It has the global responsibility for developing and manufacturing driveline components. In Eskilstuna is also located Volvo CE Customer Support AB and jointly with a branch in North America, it is responsible for customer support business within the Volvo CE Group. Volvo CE Cabs AB is responsible for complete systems for cabs, hydraulic and fuel tanks, as well as sheet metal components. The headquarters and plant are located in Hallsberg, Sweden.

In short, the machines can be described as bulky, both in terms of size and weight. The smaller machines sold in Australia and SEA weigh around five tons and the largest one, a Wheel loader, weighs 51 tons. Some machines are as long as ten meters (Motor graders) and others have a width of more than three meters (Wheel loaders). Moreover, the machines are technically sophisticated and require a substantial amount of resources in facilities and competences to be manufactured and assembled. These machines are also quite expensive, and some models cost as much as USD 250,000.

4.1.1 Volvo CE in Southeast Asia

Volvo CE Asia has its regional headquarters and Sales company in Singapore. The countries served from this office are Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Taiwan, Thailand, and Vietnam. China and India have recently been added to this regional structure. The acquisition of the Korean company Samsung heavy equipment in 1998 initiated the process of creating an industrial hub from which the entire Asian market is to be served. The Changwon plant is originally an Hydraulic excavator plant, but the strategic ambition is to move manufacturing and assembly of other product ranges to this location.[3]

There is at the moment a major reconstruction process of the distributorship in the Asian region. It is the ambition to reduce the number of dealers in

[3] Investor presentation, May 1999.

each country to one single dealer that is responsible for the marketing of all product models. Due to the economic crisis in the region, the amount of sold machines has declined dramatically with some 80% in 1998. The market situation for Volvo CE in the different segments in SEA is shown in figure 4.1.

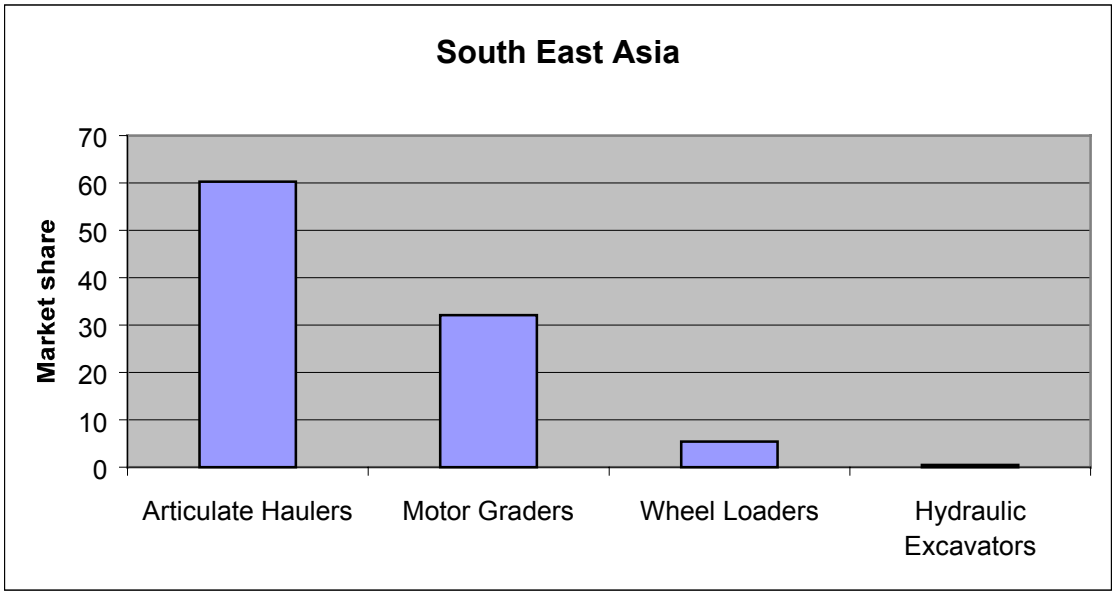


Figure 4.1 Market position in SEA
Source: Volvo CE

The Articulated hauler is the single most successful machine of Volvo CE in SEA. It is mostly sold to big customers such as international contractors in the mining industry. Indonesia is a major market for the Articulated haulers due to its high number of mines of coal, gold and tin, and represents 50-60% of the total revenues in the region. However, this is a fairly small segment in the industry with total sales of 121 machines in the region. Wheel loaders are normally sold together with the Articulated haulers to complete a fleet of construction machines for the contractors. The big models are most frequently sold and in terms of volume the most important market is the Philippine timber business. The total number of

Volvo CE machines sold during 1998 attained 151 units, which are illustrated in figure 4.2.

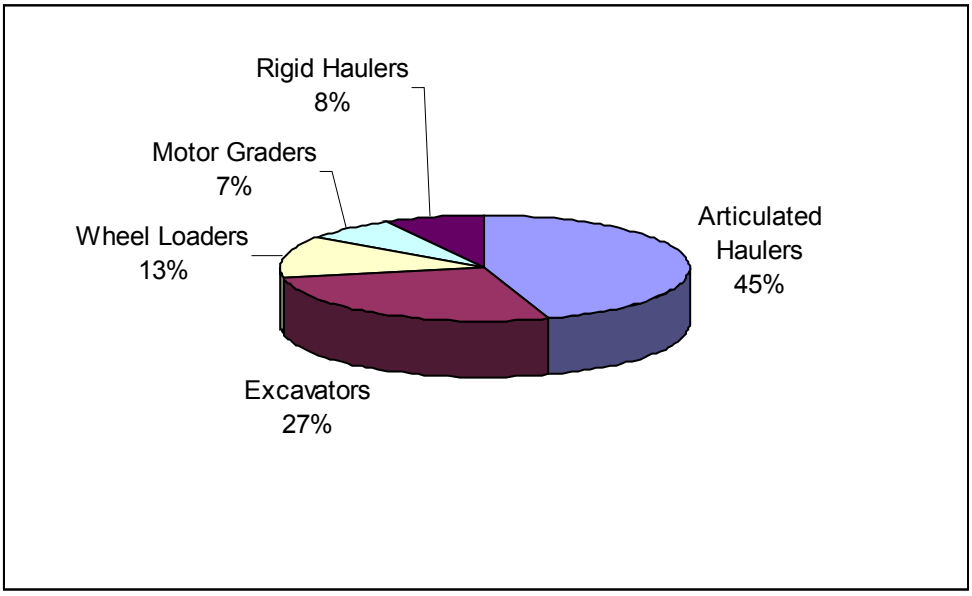


Figure 4.2 Units sold in Southeast Asia 1998
Source: Volvo CE

The single most important product within construction equipment in terms of volume is the Hydraulic excavator. From a total volume[4] of 5,797 machines sold in the East Asian (SEA, China and India) market, the Hydraulic excavators accounted for 4,846 (84%) of these machines. With the acquisition of Samsung it will become Volvo CE's most sold product range counting in units. However, in this market, Volvo CE has only a market share of 0,5%. The projection for this region is that the total volume will double in three years, reaching over 12,000 units.

4.1.2 Volvo CE in Australia

Sydney is the location where Volvo CE Australia has located its Sales company and the warehouse is located just outside the city, in Minto.

[4] The total volume is calculated on the basis of which segments Volvo CE is present in.

Australia is a huge country with an area of approximately 7,600,000 square kilometers. To compare, Australia is slightly smaller than the U.S.[5] Volvo CE has dealers in New South Wales, Queensland, Southern Australia, Tasmania, Victoria and Western Australia.

During the last two years, Volvo CE Australia has gone through a major restructuring. From having been a retailer, Volvo CE has reorganized to become a wholesaler with independent dealers. The reason for the reorganization is to create a better efficiency and have more devoted dealers that to a larger extent work with Volvo CE products, according to a senior manager in Australia. What Volvo CE wants to achieve, is that dealers have a larger Volvo CE share of mind, i.e. that the dealers' business to a larger extent should be Volvo CE products.

The situation in Australia is somewhat different compared to SEA (see figure 4.3).

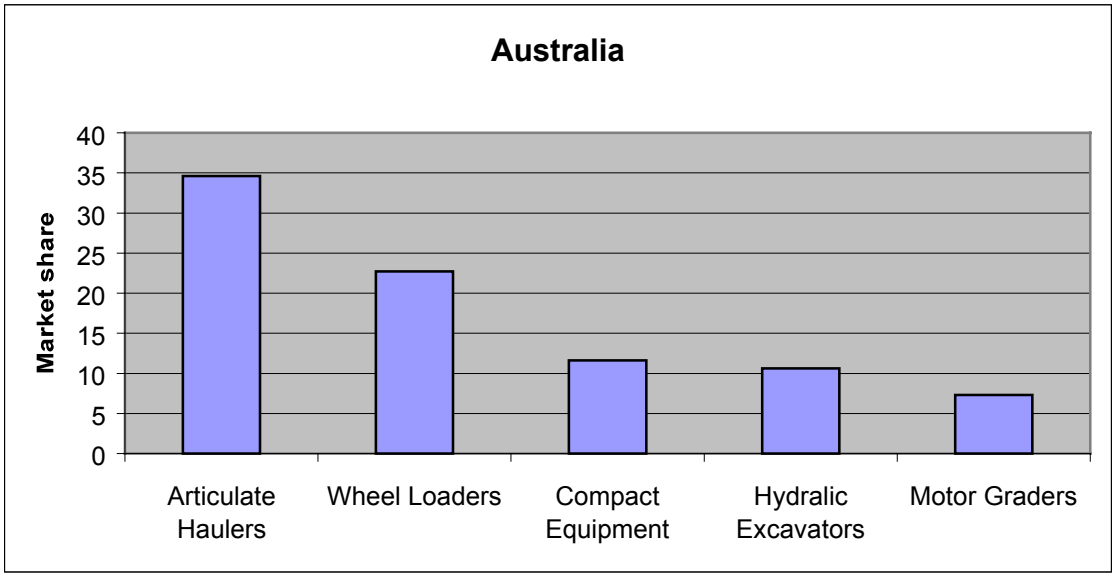


Figure 4.3 Market position in Australia
Source: Volvo CE

[5] CIA World factbook, www.odci.gov/cia/publications/factbook/country.html

Volvo CE has their strongest position in the Articulated hauler segment in Australia, although not equally strong as in SEA. Together with larger Wheel loaders these machines are sold to sand and gravel, and mining projects. Another segment that Volvo is stronger here than in SEA is in the mid-size segment (including smaller Wheel loaders and Compact Equipment), which is machines sold to general contracting and industrial customers.

The position in the Wheel loaders segment is therefore stronger with a 23% market share. In the largest segment, Hydraulic excavators, Volvo CE has a better position, carving out a 10% share of the 1,226 units. Around two thirds of the sale in Australia for Volvo CE are on the East coast. The total market in Australia in 1998 was worth 2,733 machines. The predictions are that it will slightly decline over the next coming years (Internal Volvo CE reports). The total units sold in Australia in 1998 were 383 units, which is shown in figure 4.4.

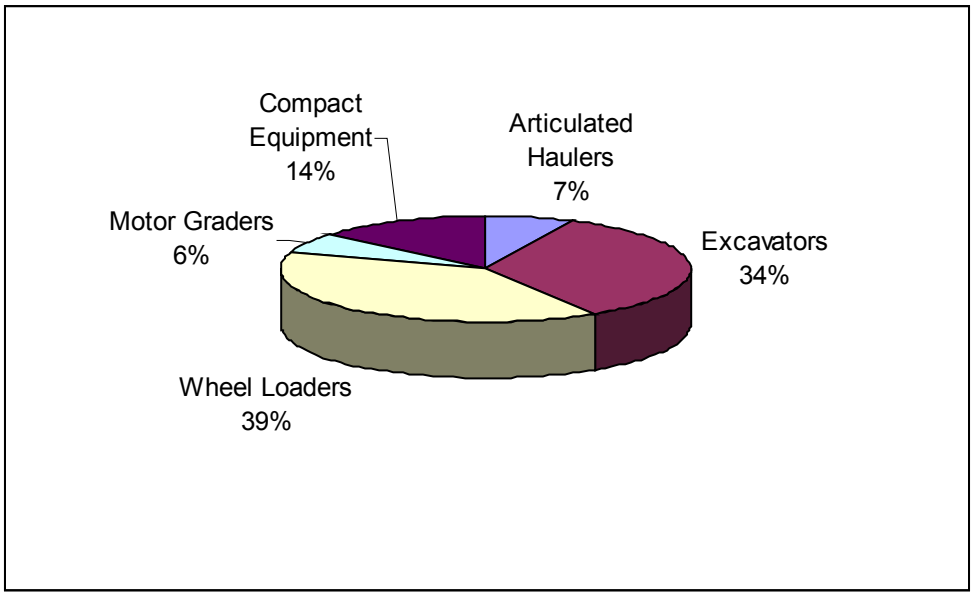


Figure 4.4 Total units sold in Australia
Source: Volvo CE

4.1.3 Volvo Transport

Volvo Transport is a unit within the Volvo Group that provides logistical services for all Volvo Group business divisions. It has 700 employees and purchased in 1997 services from 2,500 suppliers for approximately MUSD 650. Volvo Transport is a full range service provider; everything from purchasing and administration to warehousing is conducted. All this is achieved efficiently since all Volvo Companies share the same IS/IT environments.[6]

4.2 Mapping of Volvo CE's OTP process

We will in this section present how the different product, information and monetary-related flows actually take place in Volvo CE's OTP process. Since many terms and concepts are presented without any explanation, we advise the reader if necessary to look in the theoretical framework for clarifications. In addition, these flows are in reality very complex and multifaceted, which makes studying them very challenging. To help the reader understand the different flows, we have sorted out some information and simplified the processes to some extent. Moreover, it is difficult to separate these flows since they are closely inter-related in many ways, but we have purposely decided to make a division in order to facilitate a comprehensive description. Our goal has been to present a picture that truly resembles reality.

The main actors in Volvo CE's OTP process are the:

- Product Companies (PC) in Canada, South Korea and Sweden;
- Sales Companies (SC) in Australia and Singapore;
- Headquarters (HQ) in Belgium;
- Dealers in Australia and SEA;
- Freight forwarders in Australia and Singapore;
- Shipping companies.

[6] Volvo Transport presentation.

4.3 Total lead-time

To start with, we would like to present the total lead-time for a product being ordered until it reaches the warehouse and is ready for transport to its final customer. This is illustrated in table 4.1.

	CAN-AUS	**CAN-SING**	**KOR-AUS**	**KOR-SING**	**SWE-AUS**	**SWE-SING**
Dealer places an order	1 day	1 day	1 day	1 day	1 day	1 day
SC places an order to PC	1 day	1 day	1 day	1 day	1 day	1 day
Planning time	n.a.	n.a.	15 days	15 days	1-7 days	1-7 days
Production time	60-90 days	60-90 days	7 days	7 days	14 days	14 days
In-land transport	2-3 days	2-3 days	1 day	1 day	1-2 days	1-2 days
Overseas transportation	45 days	28 days	11 days	17 days	35 days	25 days
Clearance at port and in-land transport	2 days	1 day	2 days	1 day	2 days	1 day
Pre delivery check	7 days	n.a.	7 days	n.a.	7 days	n.a.
Total lead time	119-149 days	84 - 114 days	45 days	43 days	62 – 69 days	44 – 51 days
Total lead time with waiting time	**127-157 days**	**92– 122 days**	**52 – 66 days**	**50 – 64 days**	**69 – 83 days**	**51 – 65 days**

Table 4.1 Total lead-time
Source: Interviews

Since the deliveries to the final customer can vary substantially, we have not included them in this table. In addition, delays in production, caused by overcapacity limits, are not included. As vessels leaving from Sweden, Canada and Korea for Sydney and Singapore only leave once every other week, there is in reality a waiting time before machines can be shipped.

We have calculated this waiting time to be between seven and fourteen days. However, this is only an average. In reality, the lead-time can be shorter, as well as longer. The abbreviations used are:

- CAN-Canada PC
- KOR-South Korea PC
- SWE-Swedish PCs
- AUS-Australia, Sydney
- SING-Singapore.

In the coming sections we will explain how we derived these lead-times. The lead-time for the monetary flow is not presented here, because it differs greatly depending on the customer and terms of payment.

4.4 Product flow

Since there does not seem to exist a full systematic description in Volvo CE of how the products move from order to delivery, we will in this section map the current transfer process of the finished products from Product Companies (PCs) all the way to the final customers. This product flow can be illustrated as in figure 4.5.

4.4.1 Product company

The PCs have a generic manufacturing philosophy of “Sell one - make one”. This means that they basically have a non-stock policy and instead manufacture machines on orders. Since the PCs carry very low inventory of

components it usually takes a couple of weeks before the actual production process starts. This fact – although beyond the scope of our study - has by many interviewees been identified as a main reason for a long order-to-delivery lead-time to customer site.

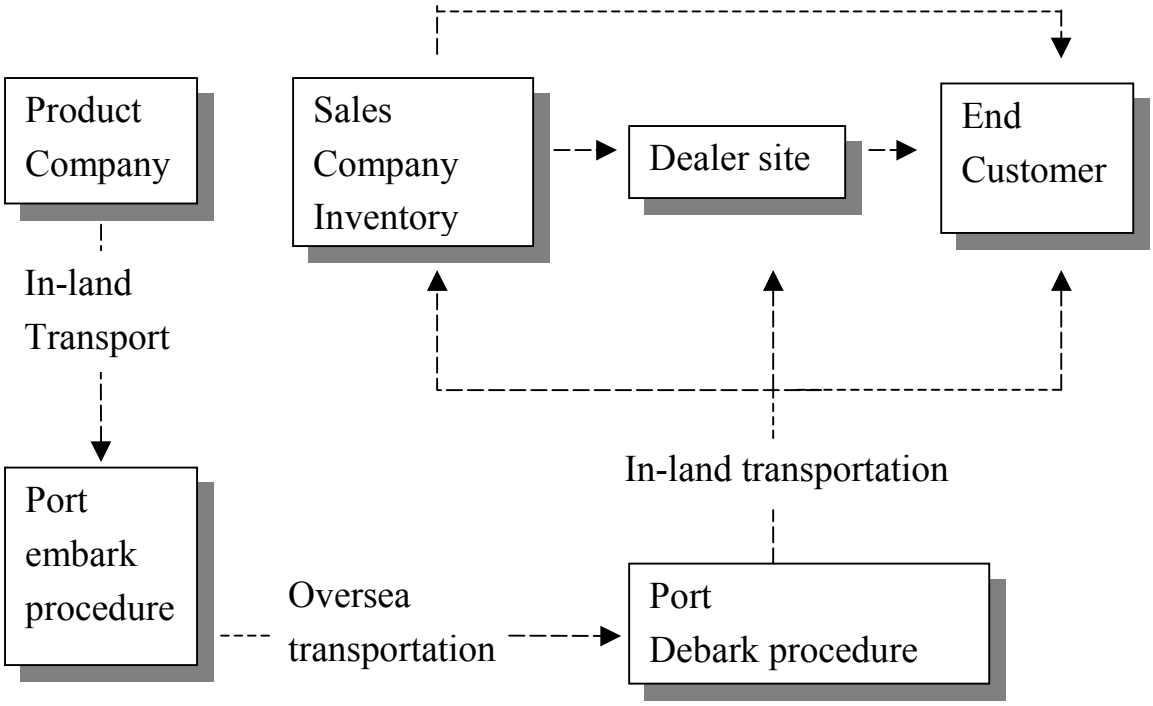


Figure 4.5 Volvo CE's product flow
Source: Interviews and our own

Another important factor influencing production lead-time is the level of customer demand at a given point due to production capacity limits. To be able to produce items as fast as possible Volvo CE has developed so-called market-related standard (MRS) models, which are standardized versions of machines for particular markets. This means for example that optional features like air-condition is included in the standardized models for the SEA and Australian markets.

The lead-time in the manufacturing process varies between the PCs. In the Swedish plants, the production processes are normally within two weeks.

The level of manufacturing flexibility is relatively high, which means that the production speed can be increased if needed.

In the Korean plant, the production time is currently seven days but the level of flexibility is not as high as in the Swedish product companies. For instance the Australian SC has to place an order before the 10th in each month to be able to get a machine produced. If the SC misses that deadline, they have to wait until the next month. Around the 25th of the same month, production starts and an excavator is produced. Since the production schedule is set for several weeks ahead, it makes modifying an order difficult once it has been placed. Consequently, a requested order amendment is carried out when its turn in the queue comes.

The lead-time for a Motor grader manufactured in the Canadian plant from order-to-built machine is approximately 2-3 months. The reason for the relatively long lead-time is because most of the Motor graders are customized and contain different components and design for different customers.

After having finished the manufacturing, the machines are placed at the finished goods inventory at the PC site. Depending on different factors, such as in correct payment procedure by customers, or political instability in the country in question, or for example that the oversea transport is delayed, the machines may remain on site for anything from one day to, in some cases, several months, according to people at the PC in Eskilstuna.

4.4.2 In-land transportation

The nature of the machines, i.e. that they are bulky and heavy, as well as the distant location of markets from the production plants make transport by sea the only feasible option. In extreme cases, for instance when a customer demands immediate transport at any costs, air transport is

possible. Hence, the machines are transferred to different ports for oversea transports.

The PCs in Sweden have agreements with different freight forwarders for transports by both rail and truck trailer to the harbor of Göteborg. In general, rail transport is preferred since it is less expensive than truck trails. However, if urgent transports is needed or when the machine is too bulky, truck trailers make transportation. In general, the transport takes approximately one day.

From the PCs in South Korea and Canada, truck trailers transport the machines to the harbors. The transport from the plant in Goderich goes either to the ports of Baltimore, Maryland, or Norfolk, Virginia (U.S.). This transport takes approximately 2-3 days and sometimes a wait at the port of 1-2 days occurs before the vessel leaves.

In South Korea, the harbors of Masan and Pusan are used. The Masan port is situated only one kilometer from the Changwon plant and is, according to a manager of Volvo CE in South Korea, the best port in Korea for outbound transport. There is, however, a major obstacle for trucks with heavy trailers heading for the Masan port, namely a bridge only capable of carrying 24 tons of cargo. This means that heavier models have to be disassembled and transported in separated parts in order to cross the bridge. The other port, Pusan, is situated 200 kilometers from Changwon and this is the port from which most of the Ro-Ro vessels depart. Transportation takes approximately one day.

4.4.3 Embark and Oversea transportation

There are different alternatives of ships that are capable of carrying the Volvo CE machines. The most preferable ship type is the Ro-Ro since it is generally least expensive and most cost-efficient. It allows embarking and

shipping of the machines as they are, i.e. there is no need for disassemblies of certain parts or use of cranes to lift the items on board.

However, the availability of such vessels is limited in the Asian and Australian regions. Ro-Ro shipping companies have reduced their scale of operations due to the Asian crisis and are more eager to serve customers that have cargo that is easy to move and high in numbers, rather than bulky and low-volume products. This is illustrated by the fact that even when a shipping contract is signed, the shipping company has given the designated cargo space to another more volume-based customer. Furthermore, according to Volvo CE's freight forwarder in Australia, all Ro-Ro vessels heading for Australia are currently over-booked with motor vehicles.

The other shipping alternatives that are available do not by far offer the same convenience for Volvo CE. The number of available container vessels is much higher than that of Ro-Ro vessels and they also embark from a higher number of harbors. However, container ships are associated with several drawbacks for products with similar characteristics as those of Volvo CE. The container sizes (6.1/12.2m x 2.4m x 2.6m) are in many cases too small for Volvo CE machines, which means that three options are available: wait for a Ro-Ro vessel, disassemble the machine in order to make it fit into the container, or have the machine transported on a so-called flat-rack. Given the low volumes of Ro-Ro vessels currently sailing it may take up to a month before a suitable ship is willing to take Volvo CE machines, according to a manager in Eskilstuna.

As earlier mentioned, disassembly of machines is not a preferred option, given the technical complexities and circumstances involved. Risks of technical problems, damages and increased costs of hiring equipment and bringing in engineers are some of the reasons. Vessels are also eager to stay in harbors as briefly as possible, i.e. products which tie up extra time in special handling procedures are not appreciated.

The last option of using flat-racks, a form of pallet on which the machine is lashed with chains and lifted on board the ship, is sometimes the only feasible choice, but is associated with two major drawbacks. Firstly, the bulky shape of the Volvo machines means that it is not possible to load other cargo on top. The shipping companies therefore loose cargo space and may charge three times more than containerized cargo, according to the freight forwarder in Australia. Secondly, the frequency of machine damage is very high when machines are transported on flat-racks. This adds costs and requires repairs before the machine can be delivered to dealer/end customer.

Oversea transports from Sweden

From the harbor of Göteborg Volvo CE has signed a contract with Hyundai's Ro-Ro shipping company, in which fixed departure day per week, destinations, and a very favorable price per cubic meter are stipulated. This vessel departure every other week and has Singapore as its first Asia before continuing to Hong Kong and final destination Japan. In some cases it also enters the harbor in South Korea. This vessel can always offer Volvo CE space since they are going empty back to Asia for a reload of cars. Departures for the port of Sydney are also taking place from Göteborg on a regular basis every two weeks. Wallenius-Wilhelmsen the largest Ro-Ro transportation company service two routes to Australia. Wallenius Wilhelmsen's total fleet is around 60 vessels traveling around the globe.[7]

Oversea transports from South Korea

Shipping departures take place from the harbors of Masan and Pusan. As earlier mentioned, there are currently very few Ro-Ro vessels available and therefore container ships are mostly used. This means that both disassembly of machines and flat-racks shipping are necessary options in order to secure transport from the ports. Vessel departures take place once

[7] www.walleniuswilhelmsen.com

every four weeks ever since the Asian crisis started. The car and container vessels that offer service down to Australia are mainly Mitsui OSK Line and K-Line according to the freight forwarder in Australia.

Oversea transports from Canada

Oversea transportation departures of Motor graders for the SEA market mostly take place from Baltimore, and from Norfolk when the machines are to be transported to Australia. The vessels leave every 10-14 days for these markets. Depending on costs and circumstances at the receiving port different vessels can be used. Container ships are a feasible option that is used when the receiving port has the capability and time to re-assemble the machine. To fit into the container size the blades are taken off at departure. This is a suitable solution since the size of the Motor graders allows transportation in containers without any major disassembly activities. Therefore, these transports can be undertaken in a fast and cost-efficient mood. The Motor grader can also be sent either fully set up or with the cab split and down on a Ro-Ro vessel.

Lead-times and shipping prices

Depending on destination, type of ship, and availability of load space, the price charged by the shipping company, expressed in USD per cubic meter, varies. In table 4.2 is a presentation of the lead-times and costs for shipping the machines from the ports of the PCs to the ports of the SC.

To understand the prices given in cubic meters, take, for example, the cost of bringing a Wheel loader from Sweden to Sydney. An L180C has a size of approximately 100 cubic meters. The cost of bringing the machine overseas is USD 5,000.

4.4.4 Transshipment

Transshipment is the activity of unloading the cargo of a vessel and reload onto another vessel. Whenever possible, Volvo CE aims at transporting

items directly to the port of end-customers' choice and at avoiding transshipments. The reasons for this are several, such as the incurred cost of approximately USD 20-30 per cubic meter, an increased risk of machine damage during the transshipment handling, and the necessity to time another available vessel for further transport, which may both take time and incur extra costs like harbor-storage fees. There are also risks of burglary when the machines are stored in the harbor area.

Routes (Product company port to Sales company port)	App. oversea delivery time (days)	Cost per cubic meter (USD)
Göteborg – Singapore	25	25
Göteborg – Sydney	35	50
Pusan – Sydney	11	4.000*
Pusan – Perth (via transshipment Singapore)	22	5.000*
Pusan – Singapore	17	35
Norfolk – Sydney	45	8.500**
Baltimore – Singapore	28	5.500**
Singapore – Sydney	10	65
Sydney – Singapore	10	45-50

**** Total price Excavator***

*****Total price Motor grader***

Table 4.2 Oversea lead-times and costs
Source: Interviews

In the case of vessels coming from Sweden, avoiding transshipments is applicable only in a minority of cases, according to the sales administrator at the SC in Singapore. As a rule of thumb, shipments with a destination to SEA need to be transshipped in the Singapore harbor. The only occasions

when Ro-Ro shipping companies consider entering other ports on the way to Singapore, are when a sufficient cargo is carried and targeted to the harbor in question. According to several interviewees, Volvo CE does not possess such large a amount of cargo units per shipment to influence the shipping route so that it will enter non-scheduled harbors. The transport manager in Eskilstuna claims that at least 20 Volvo CE machines are a minimum volume in order to have bargain power to pursue a shipping company to enter a particular port, and at the moment Volvo CE is rarely transporting such volumes to these markets.

There is a different situation for container vessels regarding the necessity of transshipping. According to a manager in Eskilstuna, container vessels enter basically every major port in the SEA and Australian area. Since the PC in South Korea often uses container vessels, there are seldom transshipments of those machines. Container vessels also stop in Singapore, which means that the largest scopes for further transport are via Singapore harbor.

4.4.5 Harbor handling and Final destination

When the items arrive at the final port, there is a similar procedure of debarking the machines of the ship as when the embarking took place, i.e. the cargo is either unloaded with cranes or rolled-off. Depending on in which country the customer is located the harbor handling is processed at different levels of efficiency. Machines need to be cleared from the ports, which in Sydney takes two days and in Singapore it is done within a day. For other harbors within SEA, the time for clearing is 3-6 days, according to the sales administrator in Singapore. In Vietnam however, the clearance process may last several weeks due to administrative reasons.

Singapore harbor

The harbor of Singapore is one of the world's busiest in terms of departures and arrivals of vessels. Its geographical location has made the port of

Singapore a focal point for some 400 shipping lines linking Singapore to more than 700 ports in 130 countries worldwide. A majority of cargo transshipment for the Asian and Australian markets takes place in Singapore harbor. It has top-modern infrastructure in terms of distribution facilities, terminals and telecommunications. The Singapore government is heavily involved in promoting the harbor as the logistical hub of Asia.[8] The efficiency at the harbor is high, according to a freight forwarder in Singapore. Getting a machine through customs usually takes less than half a day and bringing in machines to Singapore is duty free.

Sydney harbor

Sydney Ports is also a pivotal hub for trade throughout Asia and the Pacific. It is now served by more than 80 shipping lines, berthing on a regular basis for shipments to and from over 200 overseas destinations. The harbor is able to accommodate all different types of vessels. There is a substantial network of rail and road companies, which offer opportunities for further transport throughout Australia.

The harbor is not perceived to be as efficient as the Singapore harbor, according to the freight forwarder in Australia. A machine is usually, cleared within 1-2 days. In Australia, the duties for bringing in Articulate Haulers, Wheel loaders and Motor graders are 3%. Excavators are duty free. If machines are brought out of Australia again, the tax is repaid.

Warehouse policy

The final destination of machine shipping can be either SCs warehouse inventory, dealers warehouse inventory or the site of end-customers. The warehouse in Australia and Singapore is somewhat different. The constellation of machines is shown in table 4.3.

[8] Maritime & Port Authority of Singapore http://www.mpa.gov.sg/homepage/theport.html (24 November 1999).

It is the ambition that dealers should stock all machines, which are not sold directly to end-customers. However, the current economic situation in Asia has made the majority of the dealers reluctant to acquire any machine before a customer order has occurred. Therefore, Volvo CE stores a minimum of the machine models showing customer demand potentials until the economic situation in the industry improves.

	Australia	**Singapore**
Wheel loaders		
L90C	0	1
L120C	0	1
L150C	3	1
L180C	3	1
L220D	3	0
L330C	1	0
Articulated haulers		
A30C	3	0
A35C	3	8
A40C	2	0
Hydraulic excavators		
EC460/SE450	1	0
Motor graders		
780 AVHP	1	0

Table 4.3 Inventory of machines held in Australia and Singapore
Source: Interviews

The inventory held in Australia has another function than the one in Singapore. The long lead-time makes it necessary to carry an inventory in Australia, according to the logistics manager. It is also a fact that customers in Australia require to see machines when acquiring negotiations take place. The inventory therefore serves as being a speculative, safety buffer,

and demonstration inventory. All machines are transported to the warehouse yard situated in Minto outside Sydney, since they are not in a condition for sale when arriving. According to the manager of machine logistics, the machines are in need of pre-delivery activities, like polishing and having all attachments fastened. Such activities take approximately one week. Then the machines may be either shipped to the Dealer's yard or stored at Volvo CE's own yard.

Given the relatively high prices of acquiring bigger machine models, the SC takes responsibility for storing machines that are perceived as too expensive for dealers to carry themselves. Therefore, Volvo CE stores inventories on dealers' yards on consignment basis usually for a period of six months. A machine on consignment means that Volvo CE owns the machine even though it is placed at the dealer's site. If a sale does not occur during the consignment period, the dealer can either return the product to the Sales company in Sydney or acquire the machine. For the year 2000, the proportion of inventory on consignment is forecast to represent 15% of the total inventory of 136 units held by dealers. This includes the larger models of respective product group. In the longer term, the aim is to terminate consignment business and make dealers carry the inventory. Now this is not feasible, since the dealers are not financially strong enough, according to the logistics manager.

4.5 Information flow

When studying Volvo CE's information flow, we have focused our attention on the information that follows the product from when an order is placed until the product is delivered. Important factors in this process are administrative lead-time, availability and sharing of information. Another important information flow that we have studied is how sales forecasts are produced. The reason for this is the importance demand forecasting has for a variety of activities within a company. Finally, we have studied which systems underpin and transfer the information.

4.5.1 Order to delivery information

The information that is shared in the OTP process has several users. The users within Volvo CE are the PCs, the SCs and HQ. The external users are the dealer, the end customer, the freight forwarder and the shipping company. The whole information flow in the order process is illustrated in figure 4.6.

The starting point of the information flow at Volvo CE is the pre-sale of a product, i.e. the information required to make the sale. A customer needs information of everything from product standard and customer support to the price and delivery. Most of this information is updated regularly by sales information packages, personal visits, and tradeshows, and on the Internet.

The next step is when a customer places an order, which makes the dealer make an order to the SC. The order is usually faxed to the SC. When the SC receives the fax, they create and place the order on the PC. This is done in Singapore by using an online system called MAS. In Australia, this is done by fax. The reason given for Australia not having the MAS system is that it is too expensive to implement.

As the order reaches the PC it basically goes through three steps: order review, order planning and production. As the words ‘order review’ imply, the first step is to review whether the PC is able to build the machine or not from a legal and technical point of view. The next step is to plan the production, which involves customer requirements, production plan and current capacity. Available transportation options are also looked into. When everything is set, the PC sends an order acknowledgment back to the SC, either through the MAS or by fax including specifications and ready date. The lead-times for this process given by the SC in Australia and Singapore vary depending on order type, but approximate lead-times are shown in table 4.4.

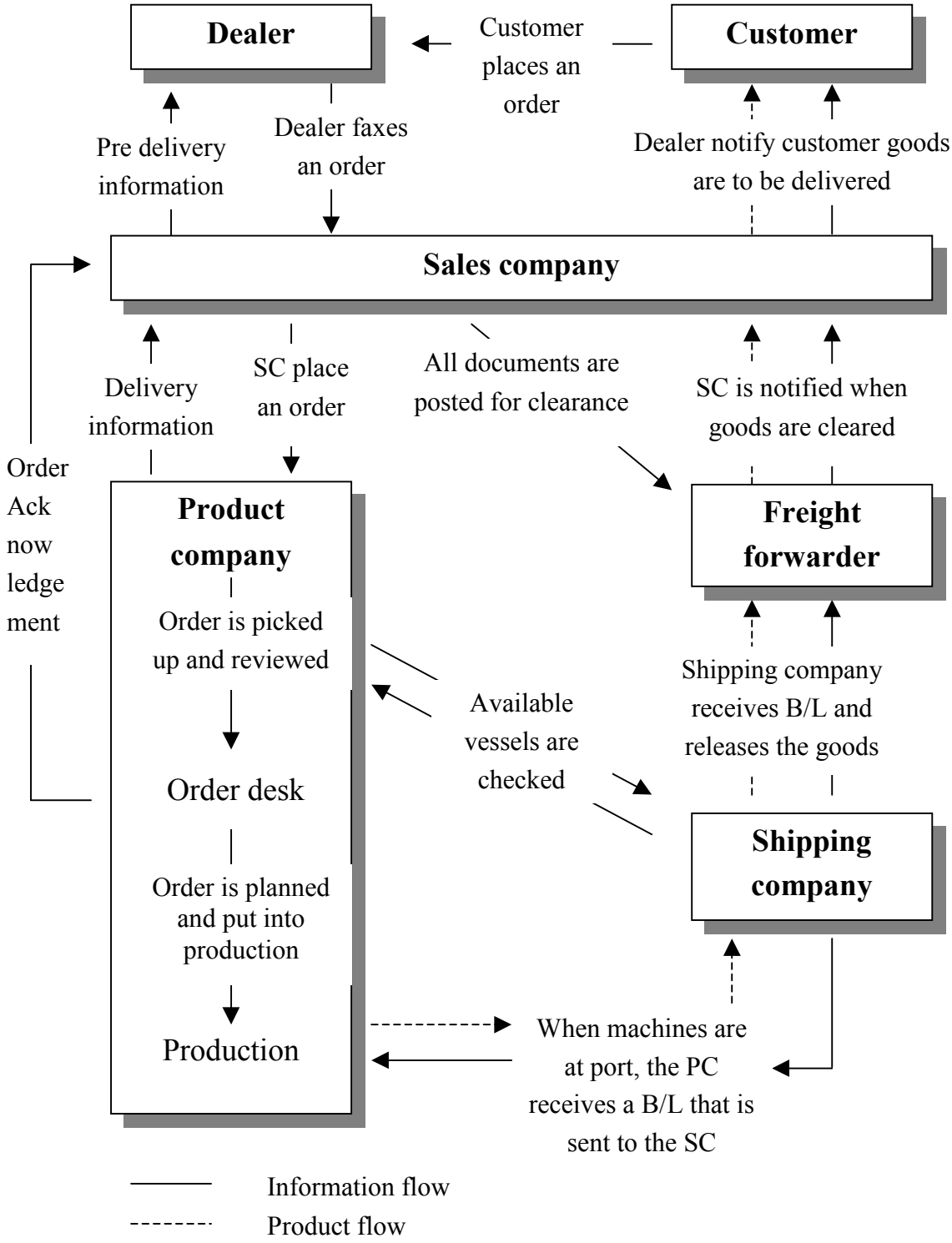


Figure 4.6 Volvo CE's Order to delivery information
Source: Interviews and our own

The goal at the PC in Eskilstuna and Braås is to acknowledge an order within 24 hours. The next step is to put the order into production. When the goods are transported and left with the shipping company, the PC is notified that the goods have arrived and been delivered to the shipping company. Now the PC receives a Bill of lading (B/L). Since this is closely related to the monetary flow, we will deal with this issue under the heading '4.6 Monetary flow'. When the goods arrive at their final destination, the freight forwarders notify the SC, which in turn informs the dealer and the end customer.

Product company	**Lead-time for Order acknowledgment**
Braås	Within 24 hours - 1 week
Changwon	1 - 2 weeks
Goderich	3 - 4 weeks
Eskilstuna	Within 24 hours - 1 week

Table 4.4 The lead-time for order acknowledgment
Source: Interviews

4.5.2 Availability and sharing of information

To illustrate how accessible information is, consider the process of finding out where a product is in the order to delivery cycle. A customer that calls the dealer and asks where his products are cannot get an immediate answer. The dealer has to call the SC, which in turn calls the PC. If the product is still not fully manufactured, the SC can be notified of this, otherwise the PC has to call the shipping company to find out where the product is. Eventually, the PC calls back to the SC, which in turn notifies the dealer and finally the customer. Neither the dealer nor the SC has any online

access to where products are in the OTP process. This process can take days.

Another example is information regarding delivery dates. To access this kind of information the dealer calls the SC, which in turn contacts the PC by telephone or e-mail. According to a manager at the Australian SC, this procedure takes 1-3 days.

Finally, several interviewees have mentioned that there are language difficulties in dealing with the PC in Korea. There also seems to be some problem in understanding each other, when it comes to accessing information as to when a product can be delivered. The PC in Korea wants the SC to place an order before they can give a delivery date. As one interviewee says, this is very difficult since the customer wants to know when he can receive the machine before he places an order.

4.5.3 Forecasting

Volvo CE forecasting periods are divided into three quarterly and one yearly report. To forecast next year's demand is a lengthy process. The stages are illustrated in figure 4.7.

(1) It all starts in the beginning of September when the sales people at the dealer collects information about the customers' intentions. This is compiled together with historical data and determines the sales volume for next year. The dealers then present these figures to the SC.

(2) In the middle of September the PCs and SCs start negotiating on the next year's volume. The SCs present their forecast for next year and the PCs have to find a way of manufacturing the desired demand. This is a form of bargaining procedure, where a match between the different demands of SCs must be found. The PCs put together a

production plan where the different SCs get a certain amount of machines each month. After three weeks the SCs present a final forecast to the HQ in Brussels.

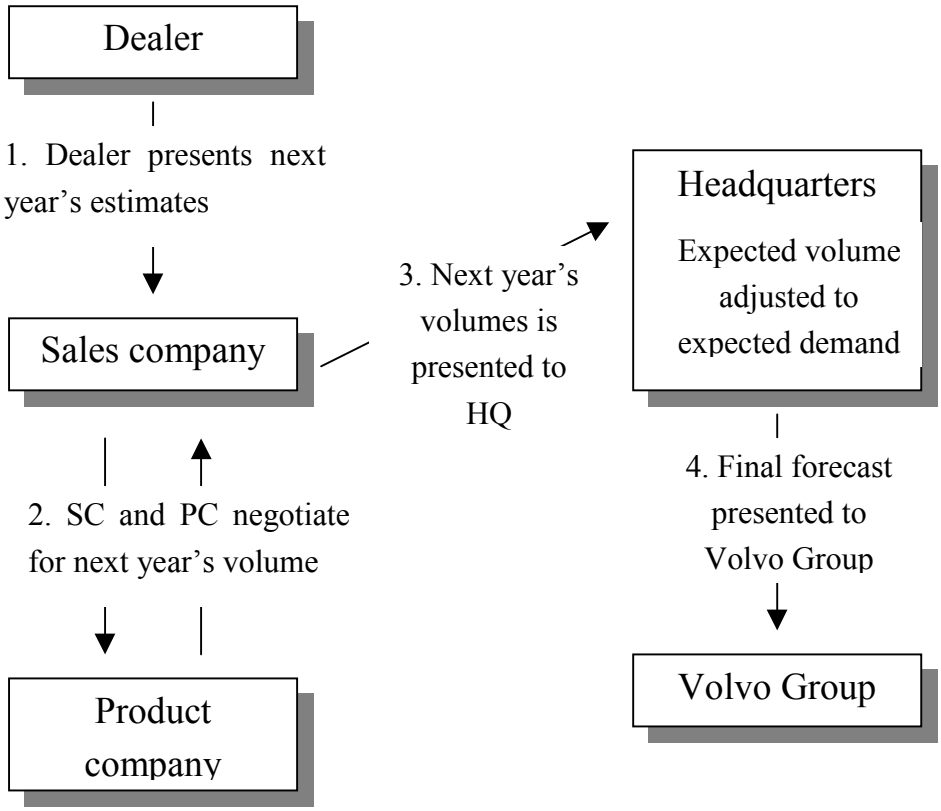


Figure 4.7 The forecasting procedure at Volvo CE
Source: Interviews and our own

(3) The HQ compares the forecasts with their estimated world market demand. The total market is estimated by considering important factors like macro indicators, interest rates and the competitive environment. According to a financial analyst at the HQ, the discrepancy between what SCs estimate and what the marketing department estimates the total market is going to be, is now down from 1000-2000 units, to 500 units on a world wide basis.

(4) The final step is when the HQ reports the forecast sales volume for next year to Volvo Group in the beginning of November. The duration of the forecasting period is about 2,5 months.

An interesting issue that has arisen during our interviews is that several managers at Volvo CE have said that forecasts are often wrong and therefore not reliable. The discrepancy between companies varies, but overall the interviewees think that the SCs are too optimistic in their forecasts, and that the quality of forecasts from different SCs vary also considerably.

The usage of a forecast

The forecast that is produced is used for several activities within Volvo CE. In manufacturing it is used for scheduling production. Since Volvo CE works after the JIT principle, holding a minimum inventory for production, both internal suppliers and external suppliers are affected. The level of inventory held at SCs' and dealers' sites is also based on the forecast. Another area where the forecast is used is for buying forward exchange. Since Volvo CE wants to avoid currency risks when conducting business in different currencies, they hedge the amount that is to be received from the customer. This is developed under the heading 4.6.

4.5.4 Information systems

Not all of the information that is transferred between different Volvo CE entities is structured in systems. Telephone contacts and faxes are commonly used when transferring information in the order-to-payment cycle. To some extent e-mail is used, although it is rapidly increasing. For the SCs in Australia and Singapore, using e-mail is a convenient way of contacting for example Sweden, since there is quite a big time difference between the two parts.

The systems underpinning the information handling in the OTP process are the MAS, the MAIN and the SAP systems. The MAS system is an abbreviation for Machine Administrative System. This is an online system that connects the PCs in Eskilstuna and Braås with the SC in Singapore. The SC in Australia does not yet have this system installed; neither does the PC in Changwon nor that in Goderich. Among other things the system is used for ordering machines, planning, invoicing, monitor stock levels, direct terms of payment, keep customer and machine data. The MAIN system is used for forecasting and for the HQ in Brussels to generate planning data from the MAS system. The SAP system is used for accounting and financial reporting.

4.6 Monetary flow

We have decided to focus on three monetary flows in Volvo CE that have the largest connection with logistics: international transactions, foreign exchange risk and transfer prices. The reason for not going deeper into this area is that monetary flows are more related to finance than logistics.

4.6.1 International transactions

Basically, Volvo CE uses two ways of arranging payments. In SEA larger fleet owners usually pay in advance or within 30 days, according to the PC in Eskilstuna. Otherwise a customer is required to present a letter of credit (L/C). In Australia customers are invoiced. Some financing alternatives are to a lesser extent given in Australia, but we will not examine them closer due to limitations of scope. In figure 4.10 is a typical case for Volvo CE shown where an L/C is involved in the transaction.

This process involves four parties: the PC, Svenska Handelsbanken (SHB), the Vietnamese customer and the Vietnamese bank, Vietcombank.

When an L/C is involved, a bank usually contacts the PC and asks if they want to open the L/C. If all the conditions are correct in the L/C, the PC

confirms it. As the goods are exchanged to the shipping company at the port, the PC receives a Bill of lading (B/L). This document is sent to the bank that waits for the customer's bank to pay for the goods. As the goods are paid for, the bank releases the B/L to the corresponding bank. The dealer or the end customer receives the B/L and can release the goods as they arrive at the port at the final destination. For an L/C that has a duration of more than 60 days and the amount is above USD 100,000, Volvo CE sells the draft to the bank and collects the payment, according to a finance manager at the PC in Eskilstuna.

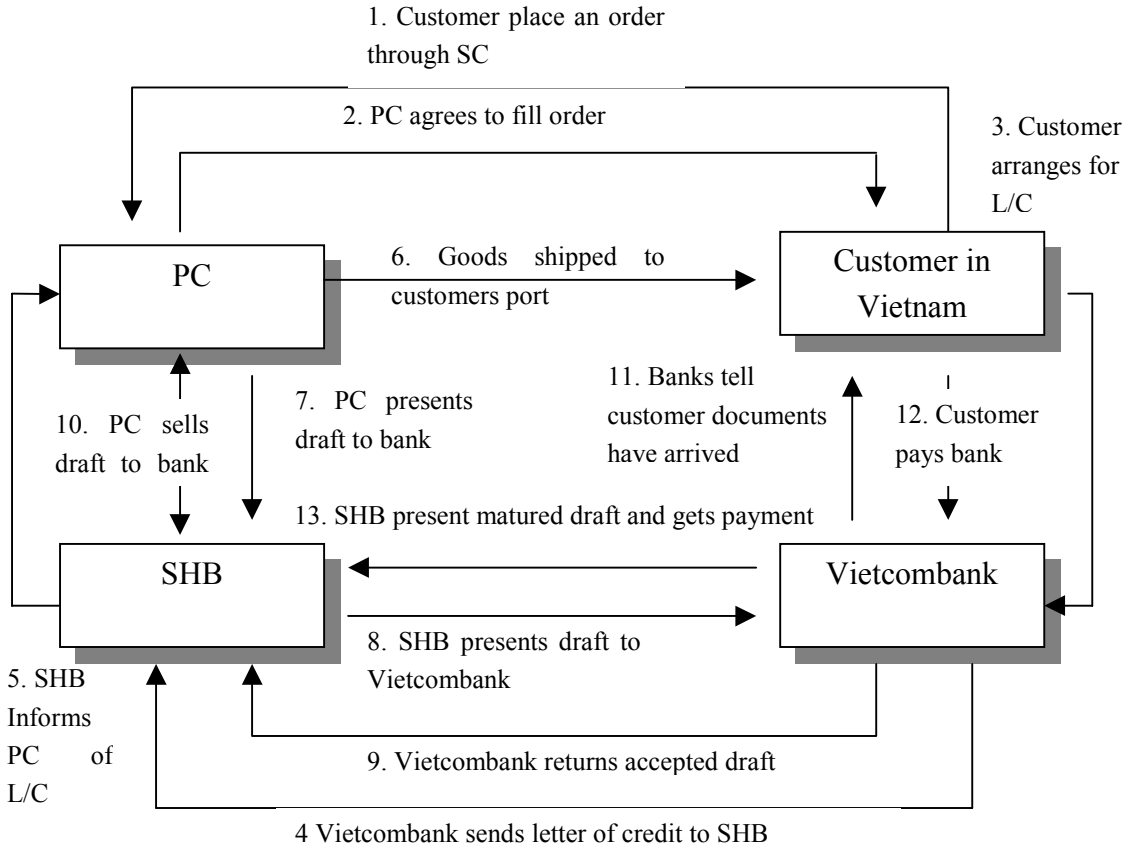


Figure 4.8 International transaction involving a L/C
Source: Interviews

For dealing in some countries, export credits guarantees are used. For the PCs in Sweden, EKN is used, in Canada EDC and in Korea the KEIC. These government bodies insure the company against among other things loss of claim, guarantee of confirmed L/C, and investment in foreign countries. These insurances are issued against a certain fee.

In the case of a normal transaction, when the customer is invoiced, the PC invoices the SC 2-3 days after the machines have been sent from the factory. The SC in turn invoices the dealer and he invoices the customer. The terms of payment in Australia are 180 days and in SEA 120 days from when the machines leave the PC. The route of the B/L is that when the PC receives it after exchanging the goods with the shipping company, a copy of the B/L is sent by fax to the SC. The original documents are later sent by post. The document for clearing the goods at the final destination, the B/L, is sent by the SC to the freight forwarder for clearing the goods.

An alternative to B/L that could be used when an L/C is not used is the waybill. This is used to some extent by the PC for Articulated haulers and Hydraulic excavators, although not by the PCs for Wheel loaders and Motor graders. The advantage of this instrument is that it does not have to be sent in original by mail. It can be faxed, making the transaction swifter, according to a manager in Australia. However, it gives less protection, which means that when an L/C is involved, it cannot be used, according to a manager at the PC in Eskilstuna.

4.6.2 Foreign exchange risk

Since Volvo CE trades with various countries around the world, they engage themselves in foreign exchange risks. To avoid fluctuating currencies they buy forward exchange to minimize the risk. The amount of money they secure is determined by the forecasts of sales volumes made by the SCs. Usually Volvo CE buys forwarders with a quoted time for two years in the future. The lion share of the amounts hedged, is the Swedish

krona to the USD, followed by Canadian dollar to USD and finally the Korean Wong to USD.

Since forecasts are somewhat inaccurate they only hedge 80% of the expected income, leaving 20% in local currencies for the coming year. For the coming two years, 60% of the foreign income should be hedged. According to a controller at Volvo CE, this means that Volvo CE is taking a financial risk since they mistrust the forecast. Inaccurate forecasts mean that Volvo CE hedges the wrong amount of capital, leading to a poor financial result.

4.6.3 Transfer prices

In Volvo CE the PCs work as the main profit centers. This means that the PCs sell the machines to SCs at prices according to production costs and desired profit level. SCs set a margin to customers that merely covers expenses, since it would otherwise be too expensive for customers. For the SC in Australia, most machines have a gross margin of less than 10%. This means that in reality the PCs set the prices for the machines, not the SCs. The reason for this framework is, according to a manager at the HQ that the SCs should not be able to lower the prices of the machines.

5. INDUSTRY ANALYSIS

In this part we will start by giving a presentation of the business environment for construction equipment manufacturers in SEA and Australia. This will be put in the context of the competitive situation. A presentation of the key success factors in the industry will follow. Finally, we will discuss future key success factors in the construction equipment industry.

5.1 Business environment

5.1.1 The Asian crisis

The economic crisis that hit Asia in the middle of 1997, when Thailand had to depreciate the Bath, severely affected the construction equipment industry. In the political and financial turmoil that followed, the construction equipment industry collapsed in this region. For most manufacturers up to 90% of the market disappeared, according to a Volvo CE manager in Singapore. One year earlier, the projected growth was 9% for the industry annually (Gross et al 1996). Due to these projections most dealers were having a significant stock of machines. The result for construction equipment manufacturers and dealers in the region was devastating. Several dealers, mostly smaller ones went bankrupt. Major manufacturers like Caterpillar, Komatsu and Hitachi had to help their dealers. Thus, the dealers avoid going bankrupt. Holdings of large inventories by the major dealers resulted in price wars. Today, the business is improving, but sales are far from what they were. In Australia, the crisis did not affect construction sales that much. However, due to the fact that all major manufacturers are present in Australia, the industry is very competitive, according to a senior Volvo CE manager in Australia.

5.1.2 Restructuring

In 1998 the construction equipment industry was worth USD 35 Billion a year worldwide. During the last couple of years the industry has been in a phase of restructuring. Larger manufacturers have acquired small regional manufacturers in order to gain economies of scale. Examples of this are Caterpillar's acquisition of Perkins Engines, Volvo CE's acquisition of Samsung Heavy Industries and the recent merger between Case and New Holland.

5.2 Competitor analysis

The largest manufacturer for the last decade has been American Caterpillar, with a 30% market share worldwide. The Japanese manufacturer Komatsu is second with an 11%. Third is the newly formed company between New Holland and Case with around an 8% share. Volvo CE is the fourth largest with a share of 6% (Investor presentation May 1999). Since Caterpillar and Komatsu are the largest companies in the industry, our competitor analysis will focus on these two.

5.2.1 Strategy

Caterpillar's strategy is to increase the market share, primarily in developing countries, and develop new products and product families (White 1998), thus maintaining the No. 1 position. Caterpillar's strongest position is in the heavy equipment industry. Having established a dominant position in this segment, they are now focusing on their competitors' territory (Marsh and Wagstyl 1997). During the last couple of years they have entered the compact construction equipment segment and started to manufacture farming equipment. The reason for this expansion is to create economies of scale in production and distribution. By broadening the product range they are able to produce major components at a lower cost than competitors.

Recently, the importance of soft products has grown significantly. Caterpillar is exploiting every opportunity they have to tie up customers through various financial agreements. According to the SC in Singapore, Caterpillar is today offering customers finance at very low rates and zero down payments in some countries. In addition to strong financial backing, they are also offering an extensive product support.

Komatsu is also focusing on growth and aims at becoming the No.1 player in the industry. Currently, Komatsu has a strong position on the Japanese market and is trying hard to grow outside Japan. The strategy is to grow through establishing joint ventures. Komatsu believes it will get faster access to markets, lower-cost components, and access to new technology (Komatsu Annual report 1998). In contrast to Caterpillar, Komatsu designs its products on a cost basis, which means that it first decides a price for its products and then constructs it accordingly (Cooper et al 1996).

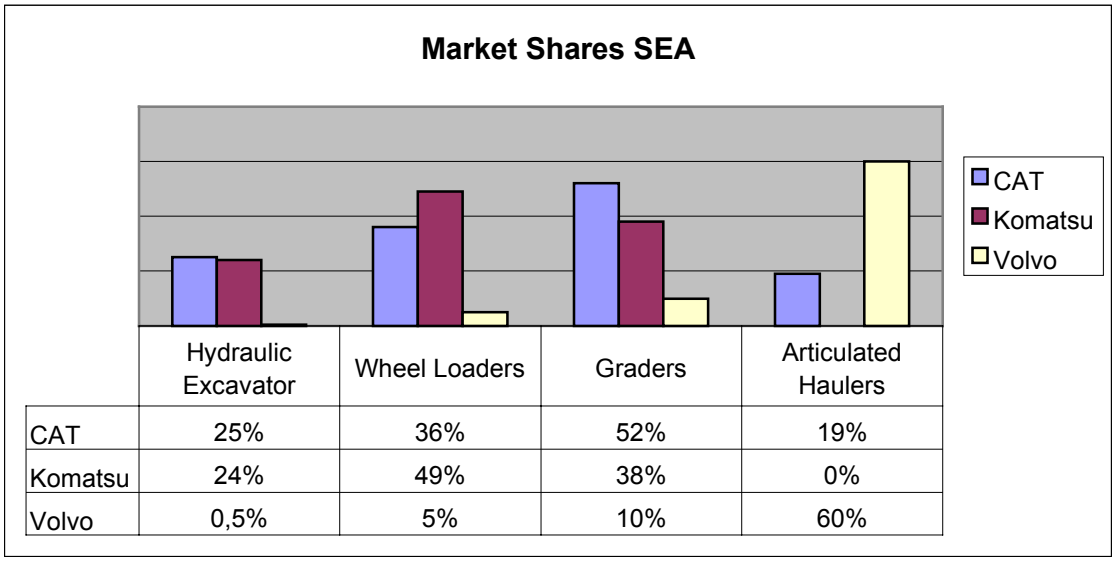
5.2.2 Resources and Capabilities for logistics excellence

In the Asian and Oceania region both Caterpillar and Komatsu have local manufacturing. Caterpillar has manufacturing in Japan, Indonesia, China, India and Australia.[9] Komatsu has most of its manufacturing in Japan, but some manufacturing is also done in Thailand, Indonesia, China and India.[10] Compared to Volvo CE, which only has manufacturing of Hydraulic excavators in South Korea and just recently started to assemble a model of the Articulated haulers, both Caterpillar and Komatsu have a much stronger presence in the region. In addition to this, Caterpillar and Komatsu are holding larger inventories than Volvo CE. This has partly to do with the crisis in Asia, as earlier mentioned, but the main reason is that they have a strategy of holding a larger inventory to be able to support customers swiftly with new products. In this respect Volvo CE has a competitive disadvantage.

[9] www.cat.com (1 November, 1999)
[10] www.komatsu.com (1 November, 1999)

5.2.3 Market situation

The most important product segment in terms of units sold in the construction equipment industry on a world basis is Hydraulic excavators. The same is true regarding the two markets we are studying. In SEA the competition is quite fierce between the two largest companies Caterpillar and Komatsu, which hold approximately one fourth of the market each. Volvo CE is far behind these two with a 0,5% market share. In the Wheel loader segment, Komatsu has almost half the market. Volvo CE's strongest position is in the Articulated hauler segment where they hold a strong 60% of the market. For illustration see figure 5.1.

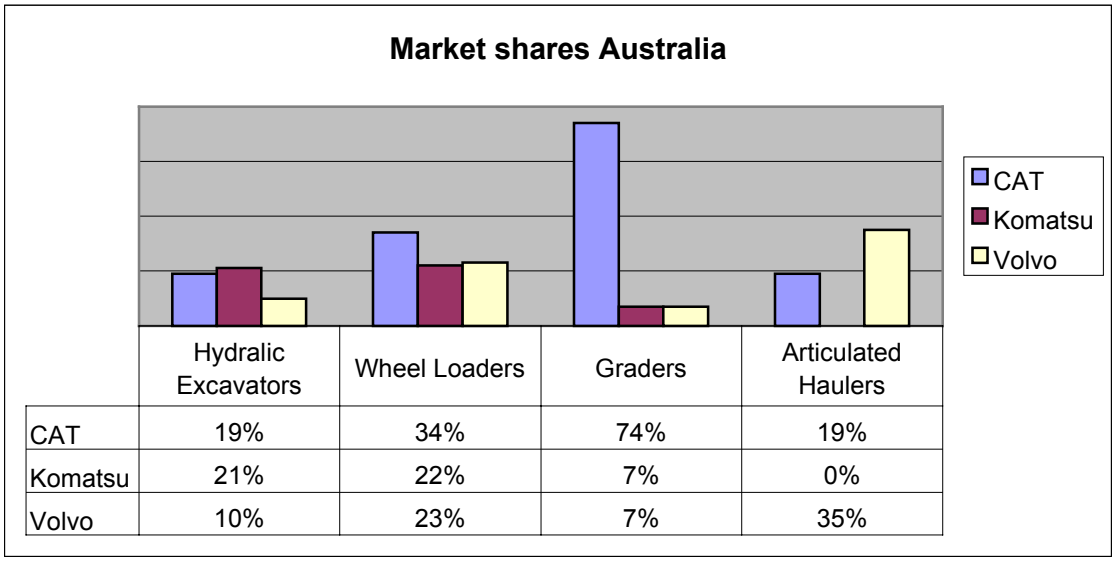


	Hydraulic Excavator	Wheel Loaders	Graders	Articulated Haulers
CAT	25%	36%	52%	19%
Komatsu	24%	49%	38%	0%
Volvo	0,5%	5%	10%	60%

Figure 5.1 Market shares in SEA
Source: ERG

On the Australian market, the situation is somewhat different. Komatsu is the biggest force in the Hydraulic Excavator segment, closely followed by Caterpillar. Volvo CE has a much stronger position on this market compared to the one in SEA. What is most notable on this market is Caterpillar's strong position in the Grader segment where they hold 74% of the market. The position of Volvo CE in the Articulated hauler segment is

not as dominant as in other markets. For an illustration of market shares, see figure 5.2.



	Hydralic Excavators	Wheel Loaders	Graders	Articulated Haulers
CAT	19%	34%	74%	19%
Komatsu	21%	22%	7%	0%
Volvo	10%	23%	7%	35%

Figure 5.2 Market shares in Australia
Source: ERG

5.2.4 Customer characteristics

Both in Australia and SEA, customers demand fast delivery of an excavator. Since Japanese, Korean and American manufacturers fight over the same customers, prices are very competitive according to a Volvo manager in Australia. To be able to compete, a manufacturer must hold an inventory and be able to supply products at a low cost, i.e. a manufacturer must achieve economies of scale in all parts of the internal supply chain.

In the other two segments that we have examined, Articulated haulers and Wheel loaders, the need for holding an inventory is not the same. Larger customers ordering a machine fleet plan ahead, which enables production after an order has been placed. However, smaller customers wanting swift deliveries are more difficult to satisfy for Volvo CE. The market for Motor graders is highly dependent on government tenders. Winning these is a matter of good connections and strong customer support according to a Volvo manager in Australia.

As earlier mentioned, the importance of soft products has grown. Caterpillar has been the strongest promoter of these in the industry. Komatsu has been fairly active as well. Volvo CE, however, has just recently started to work on these issues. Through these activities Caterpillar has strengthened the image of their products, and thus enhanced the brand value.

Several people that we have interviewed both in Singapore and Australia have said that Caterpillar's product quality is not better than that of Volvo, but their strong product support of soft products gives them an advantage over Volvo CE. Today, Volvo CE is quite far from where Caterpillar is operating, although working hard to achieve the same standard.

5.3 Industry key success factors

An important aspect to consider for achieving a competitive advantage is the key success factors in an industry. As mentioned in the theoretical framework, the focus should be on what customers want and how to survive the competition. From an Investor presentation in May 1999, Volvo CE presented the following factors as keys to success in the construction equipment industry:

- A strong franchise concept;
- Access to strong, dedicated, regional distribution – high share of mind;
- Scale for competitive advantage and reduced risk;
- Participation in the higher growths segments;
- A strong and profitable base as a platform for a pro-active participation in industry growth and restructuring.

According to an earlier study made by Gross et al (1996), the key success factors in the construction industry are production volume, pricing, outsourcing, parts availability, service network, financing, technology, and

quality. The importance of these factors depends on how large the customers are and in which country they are operating. Customers in more developed nations emphasize lifetime costs, access to credit, high product quality, and maintenance support. The customers in industrializing countries look primarily at the price, as they have limited access to credit, and parts availability is crucial, since they buy used equipment.

The key success factors that are mentioned by Volvo CE are actually a description of Caterpillar. They are and have been the benchmark in the industry for a very long time. Caterpillar possesses a very broad network of large dealers worldwide. Caterpillar has created large-scale economies by manufacturing a broad range of products within the construction, mining, and farm equipment industry. By broadening their product range, they are able to produce expensive components like engines and turbines at a much lower cost than anyone else, thus they are creating a competitive advantage by being more profitable. By manufacturing in various countries, they are reducing the risk of currency fluctuations. They are also able to supply customers with machines, within a relatively short period of time due to their local inventories.

5.4 Future key success factors

In comparison to the key success factors mentioned in the earlier section, we would like to add two factors we think would grow in importance during the next coming years.

Monitoring lead-time

The companies that will be successful in the future do not put all their efforts at monitor costs, but on focusing more on monitoring lead-time. The importance of time is already seen in a variety of industries and it is gradually growing the heavy equipment industry. Since competition in the examined markets is so fierce customers can easily go to another supplier if a particular manufacturer is out of stock. The company that is able to have

the shortest order to delivery cycle will be the one that gets a competitive advantage.

Excellent offering of soft products

We have seen during our study that for instance Caterpillar is able to sell products that offer lower quality than Volvo branded machines, but due to their support for soft products they are able to sell more machines than Volvo CE. What is happening is a major shift in customer requirements. Customers do not just calculate how long the machine will last. Instead they consider the best overall alternative, which includes factors like how fast a broken machine can be fixed, what kind of financing alternatives are given, second hand value, etc. The customer is acquiring machines from a 'holistic perspective'.

5.5 Tough competitive situation

When adding all these parameters together, it is apparent that Volvo CE is facing a very tough competitive situation. Volvo CE has longer lead-times than the major competitors, since they do not have local manufacturing as Caterpillar and Komatsu have. In addition, competitors are holding larger stocks of machines which underpins this even further. Caterpillar is maintaining their dominance in the industry, thanks to their first mover advantage. Komatsu, that has its strongest position in this part of the world, is an equal to Caterpillar in Asia, making attempts from Volvo CE to break the dominance of the two even harder.

6. ANALYSIS OF VOLVO CE'S OTP PROCESS

In this part we will analyze Volvo CE's OTP process. We will start by diagnosing areas for improvement. When analyzing the reasons for inefficiencies it is important to be able to differentiate between symptoms and causes and find the underlying reasons. Finally, we will present different alternatives to solve the discovered problems.

6.1 Diagnosis

In our study of Volvo CE's OTP process, we discovered several problems. Some of them were very obvious while others were not easy to find. To determine which problems that were the more serious ones we put them all into a relevant context, i.e. customer requirements and the competitive situation. From that perspective, we have identified four shortcomings that influence the different flows in the OTP process in various degrees (see figure 6.1).

6.1.1 Difficult to forecast the right volume

To predict what the future holds is always difficult. Inaccurate forecasting influences the efficiency of product, information, and monetary flows. The reasons for Volvo CE's forecasting discrepancy are the following:

- The large differences in these markets in terms of political and financial stability. The difference of making forecasts for a stable economy like Australia's is large compared with an emerging country like Indonesia. Several Asian countries are still struggling with the problems that arose during the Asian crisis. The political and financial turmoil that followed, makes forecasts very much dependent on factors outside the scope of the actual business.

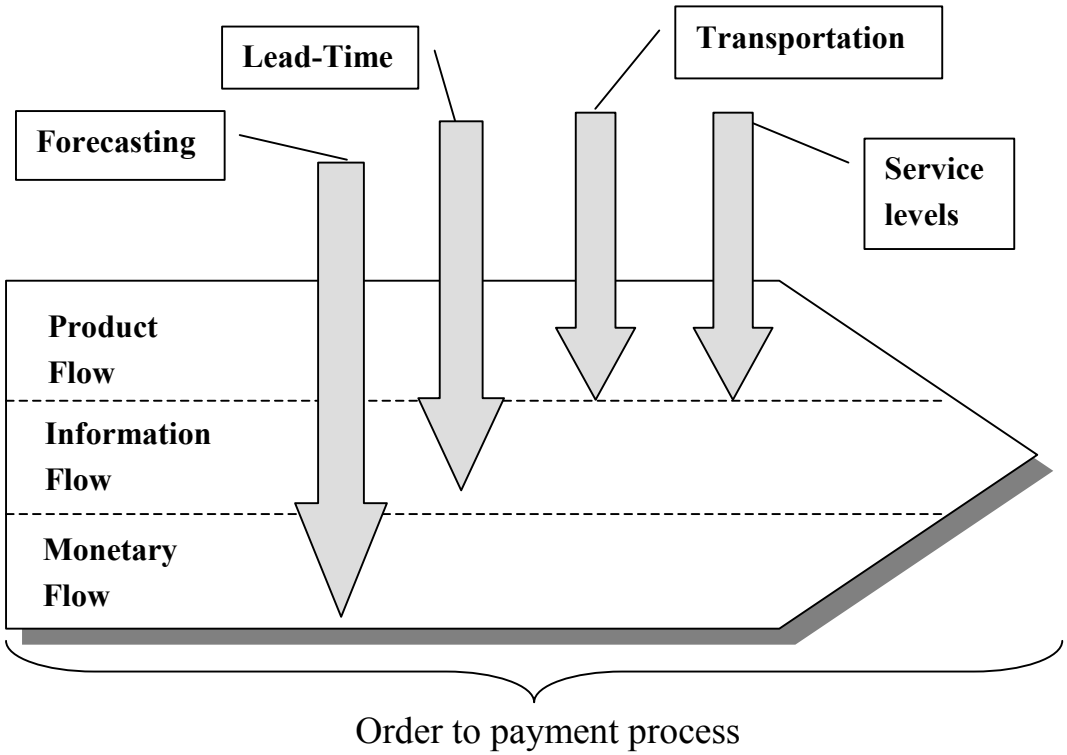


Figure 6.1 Diagnosis of problems in the OTP process
Source: our own

- A lack of common forecasting methods and procedures at dealers and SCs. There is not a "corporate method" of conducting forecasting; instead different SCs have their own ways of forecasting sales. Most forecasting in SEA and Australia is based on dealers and SCs guessing and evaluating previous years sales against the prospects for next year. This means many uncertainties and much subjective evaluation.

- There is a time span of approximately five months between the forecasting period starts and when it will be applied. Since several things may occur on the market within that period, it means that the initial forecast may be unreliable and indeed false. Since several people we spoke to said that the biggest effort is made for the yearly

forecast, the following quarterly forecast will not receive the same interest.

- The various skills and experience of the people conducting the forecast at the different entities within Volvo CE and at the dealers. Our study has discovered that the qualities of forecasts are somewhat different between the SCs. A major reason for this is that many of the dealers in these regions are new to Volvo CE and therefore quite insecure as to how many machines they will sell. We understand that it is difficult to implement new standards as new dealers join the organization and that most of these problems will be dealt with as time passes. The question is if there are any better ways of solving this problem.

- As mentioned earlier (page 83), most of the forecasting is based on historical data. The historical sales could in some cases be good to rely on, but it also gives a 'defensive' forecast, which has the result that resources are not devoted to certain markets. Thus sales are missed because of wrong priorities. Neither is there any system generating data that could be used for better forecasting.

6.1.2 Long lead-times to final customer

It has been obvious in this study that lead-times are relatively long. Long lead-times are symptoms of other variables, which in the product flow we identify as:

- Lead-time improvements are not regardered as a way of improving efficiency. The focus is rather on how costs can be reduced in the different logistical activities, with a low concern for its further implications in the product-flow chain. Optimizing individual logistical activities, such as reducing inventories, means that distant customers have to wait longer for machines to arrive.

- The long distribution lead-time is a result of distant manufacturing. Since most of the products for the Asian and Australian markets are manufactured in Europe or North America there are huge geographical distances the machines have to travel.

- There is a lack of transportation options. In general, there is a relatively low number of available vessels that serve these kinds of products. For example, interviewees mentioned that cars bypassed Hydraulic excavators from the South Korean factory since shipping companies rather transported them.

- Volvo CE and dealers are not holding much inventory and therefore lead-time becomes longer. The reason for this situation is that it is too expensive to hold an inventory, according to several respondents. We will deal with this issue later. The consequences are that there are long lead-times for customers before machines are at their disposal.

- Some of the facilities are producing at full capacity, prolonging the production lead-time, in some cases more than one month. As we discovered talking to different people at PCs, the lack of components inventory is a bottleneck in the sense that it makes production lead-time longer. However, this is beyond our scope and we will not go into this in detail.

- The production philosophy of 'sell one – make one' is also a reason for long lead-times. The reason given for this production policy by Volvo CE managers is that the machines are customized to a large extent. Not having any machines waiting for shipment at the PCs when an order is placed increases lead-time.

The information flow is showing long lead-times in the following ways:

- A slow internal handling. By not having sufficient systems or methods of dealing with the information connected to the product flow, the administrative lead-time increases total lead-time. The official version of the SC in Australia is that the MAS system is too expensive to implement.

- The information is sometimes difficult to access for concerned stakeholders, making the process lengthier than necessary and taking unnecessary resources into account.

6.1.3 Transportation bottlenecks to Australia and SEA

Having transportation to these markets in an efficient and secure manner has been a major problem for Volvo CE. This dilemma influences the product flow in the following ways:

- By perceiving the transportation problem, as externally related Volvo CE is not trying fully to solve this issue. Several interviewees said that there is nothing they can do or make to influence the shipping companies in terms of shipping routes. Instead, they are forced to follow the routes that the shipping companies offer. This means that the transportation is not as efficient as it could be with better transportation options.

- There is a lack of vessels that are able to carry bulky and heavy cargo. As mentioned earlier (page 70), Ro-Ro vessels are the preferred option since they make transportation easier, less expensive and safer. The time at ports also becomes shorter, reducing embark and disembark costs. Since there is a shortage of these vessels, Volvo CE machines may have to wait longer to be shipped before an available vessel is found. For instance, the largest Ro-Ro

transportation company in the world, Wallenius-Wilhelmsen, has around 60 Ro-Ro vessels transporting mostly cars around the world.

- Having few vessel options for further transport reduces flexibility, which makes bargaining with shipping companies difficult. The low number of units being transferred at the moment makes shipping companies less interested in shipping Volvo CE products directly to required destinations. This means that transshipment of the cargo to other vessels must occur. Such activities increase lead-time, ranging from everything from one day to several weeks, according to several respondents, as well as transportation costs of approximately 20-30 USD per cubic meter. To cope with this problem Volvo CE is trying to avoid transshipment, but for transports from Canada and Sweden this is very difficult to achieve.

- The majority of shipping companies are reluctant to carry Volvo CE products if they can choose other cargo, according to several interviewees. The machines are considered bulky, they take much time to embark and disembark, and it is not possible to put anything on top of them, compared to containers that could be piled on top of each other. This increases costs and makes it difficult for Volvo CE to argue for including their machines in cargo.

6.1.4 Low service levels

Volvo CE has decreased its level of machine inventory to such a degree that some customers perceive the company as not able to serve them properly. The reasons for the low availability of machines are the following:

- The most obvious reason is of course that the products are expensive. Holding large inventories then becomes a major alternative cost. For a company to be cost competitive today, it cannot hold too much

stock if the stock is not turning often enough. Most machines are turned 1,5-2 times a year making alternative costs rather high. Since both SCs and the dealers are holding low levels of inventory, they are not able to swiftly supply customers.

- Long distances between PCs and customers make fast supply to customers hard to achieve. This has been thoroughly explained in the previous sections.

- SCs have low margins on machines. As it is right now, the PCs are profit centers in the Volvo CE organization. This means that they sell machines to SCs at price levels to gain profits. The cost of holding inventory for an SC is then further emphasized. It also becomes difficult for SCs to offer a strong support of soft products. These services are quite expensive to market, but build strong bonds with customers.

6.2 Below the surface - underlying reasons

After having identified the visible shortcomings of the OTP process, and discussed their background, the next step is to uncover what underlying factors cause these problems. We believe that, just like the metaphor of an iceberg, the visible surface only reveals the symptoms and that the critical reasons for inefficiencies are hidden below the surface. Just merely attacking the symptoms will lead to an inefficient way of dealing with the real problems.

We have identified four underlying reasons that we think cause the inefficiencies in Volvo CE's OTP process. It may be that other factors influence the shortcomings at an even deeper level, but we perceive these underlying reasons as directly linked to logistics, and therefore the most relevant to highlight. They are illustrated in figure 6.2.

6.2.1 Establishing the underlying reasons

The underlying reasons we present have been established through analyzing what the real problems are. The *neglect of transportation importance* is a result of in fact that transportation is perceived as an external problem that cannot really be solved. Volvo CE has to adapt to the circumstances and use the vessels that are available. As we see it, there are no concrete ambitions to change or improve this transportation situation. As a consequence, transportation lead-times are increased as available vessels may not go directly to the desired port or they may even be reluctant to accommodate Volvo CE machines.

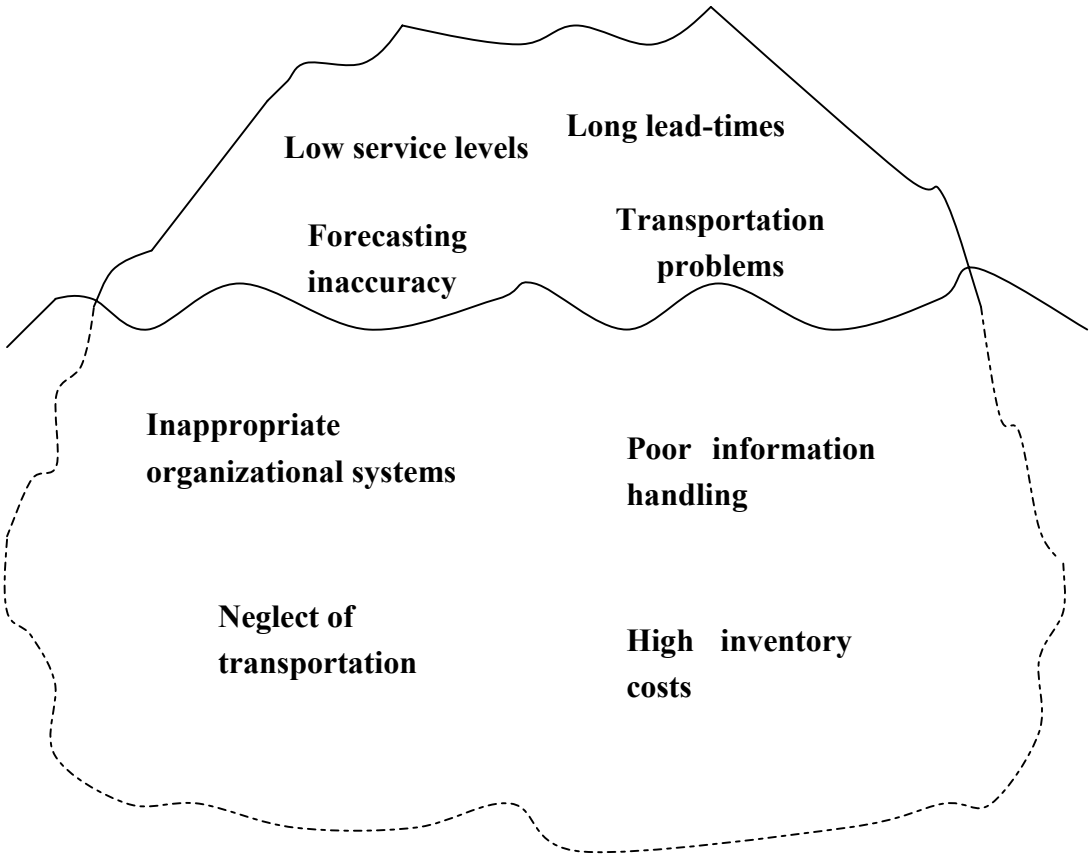


Figure 6.2 The iceberg model
Source: Our own

We see *high inventory costs* as caused by the expensive nature of the machines and high transfer prices set by the PCs. *Poor information handling* is seen in activities related to administration and communication. What are lacking are methods of and systems in handling the information. Long administrative lead-time and inaccurate forecasts are the most obvious shortcomings. Finally, the *inappropriate organizational systems* are a result of the PCs maximizing their result and the SCs theirs. Having the PCs as profit centers results in SCs paying a high transfer price for products, in turn resulting in an unwillingness to carry certain inventory levels. The results are long lead-times and low service levels.

6.3 Neglect of transportation

The importance of proper transportation solutions cannot be exaggerated, given the competitive situation Volvo CE is in, as well as the enormous geographical distances between PCs and the examined markets. Due to the strategic choice of having minimum levels of inventories, the success of a functioning product flow to customers is dependent upon how well the transports are carried out. As today, when vessel availability is relatively low within these regions, transportation is a major contributor to long lead-times to customers. In comparison, a customer in SEA may have to wait more than 6-7 weeks for a machine, due to transport and transshipment activities, while Caterpillar and Komatsu, having large inventories located within the region, can supply the same customer faster.

In addition, transport impediments occur regularly for Volvo CE when transporting to customers/dealers. Since the availability of the “safe” Ro-Ro vessel is severely limited within SEA and the region close to Australia, transportation is in many cases carried out by container ships. As earlier mentioned, the physical characteristic of a Volvo CE machine do not match the sizes of containers, and must consequently have some parts disassembled or lifted onboard on flat-racks. Such activities raise costs since they take time and often lead to physical damages on the machines.

Increased lead-times do in many cases induce higher costs of transportation. These factors are illustrated below in figure 6.3.

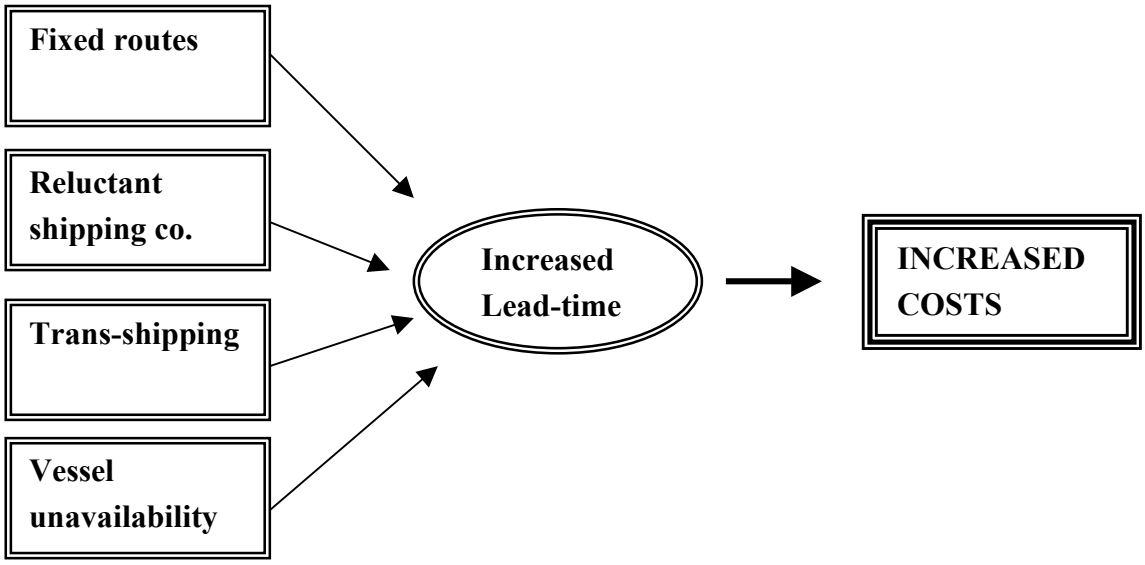


Figure 6.3 Increased lead-times – increased costs
Source: our own

Fixed shipping routes are standard among the global shipping companies. They normally enter harbors of importance on a regular basis, but may enter other harbors if a sufficient level of cargo is intended for that country.

As earlier mentioned, the ambition of Volvo CE is to have the machines delivered direct to either end-customer or the dealer.

A couple of respondents claim that Volvo CE needs to have at least 20 machines onboard a vessel to be able to influence a shipping company to enter a particular harbor not on a scheduled route. Presuming that the projected sales volume is doubled for the construction equipment industry in East Asia in the next two years, and that Volvo CE also would double its volume (to around 300 sold units per year) they would ship on average 25 machines per month to 13 different countries. This indicates how difficult it

is for Volvo CE to influence shipping companies regarding a particular harbor stop due to their low transport volumes.

Vessel unavailability has been discussed earlier. Many vessels are currently overbooked, which means that the Volvo CE products have to be transported with vessels requiring machine disassembly, higher costs or storage while waiting for a suitable vessel to arrive. To some extent it is a vicious circle – preferred vessels are overbooked or allow limited cargo space, which hampers the possibility of having enough machines transported to a particular port outside the ordinary vessel schedule. The wait for available vessels or disassembly activities increases lead-times and costs.

Transshipping procedure is how the machines get by the problem of reaching particular harbors when direct delivery is not possible. It means, however, that the machines are transferred via another harbor before arriving at the customer site. It takes longer and also incurs substantial costs when moving products between vessels in the harbor. Transshipment costs are, as earlier mentioned, around USD 20-30 per cubic meter. Such additional costs represent approximately 10-20% of the gross profit margin of the machines for sales in SEA. Given the relatively low shipping volumes Volvo CE represents of a vessel cargo, in comparison with transportation of automobiles and trucks, transshipping is often a necessity in order to reach the final destination at the customer site.

Reluctant shipping companies refer to the earlier discussions of the unwillingness of many shipping companies to transfer bulky and heavy products. They give priority to volume-based customers with easy-to-move products. Either they charge Volvo CE a higher price per cubic meter for transporting the machines or they simply let space to other customers. Having few options for transport means that Volvo CE in many cases is completely dependent on the will of the shipping companies for transfer of machines.

When one understands how many potential obstacles Volvo CE is facing, as well as how cost levels are incurred regarding the transferring of machines, it is surprising to find that not much is done in order to reduce these potential pitfalls. It is important to consider the future consequences when more production and assembly will take place in the Changwon facility for the Asian and Australian markets. How can the advantages of being closer to the customer with manufacturing be exploited if there are vessels available for Asian and Australian markets only sporadically?

6.3.1 Relationships as a way to eliminate transportation bottleneck

Up to now Volvo CE has adapted to this situation with various success. From the PCs in Sweden there are guaranteed shipping deliveries from Göteborg to Singapore on a fixed-day basis at a very favorable price. However, the other PCs and the further transfer from Singapore to the Asian and Australian markets are solved more on an ad-hoc basis, leading to uncertainties of when and how machines will reach the customer.

It has been apparent that the lack of vessel availability within SEA and down towards Australia causes a major obstacle for a cost-efficient transfer of machines to these markets. Given the projected increase of sales volumes of approximately 100% within two years in East Asia, it becomes even clearer that the transportation issue needs to be solved. The current situation of basically no available Ro-Ro vessels from the future Asian production hub in South Korea means that the potential transportation lead-time reduction is missed.

As shown in table 4.2 (page 73), transports to SEA and Australia are approximately two weeks shorter from South Korea than from Sweden. Today, shipments from Sweden, for example, do not take much more time than a shipment from South Korea to a customer in Australia. The reason is

that more obstacles exist from the harbors of South Korea, like in-land transport restrictions, typified by the 24 ton maximum weight capacity of a bridge on the way to Masan harbor, making disassembly of machines necessary.

The lack of appropriate vessel types means that containerships are basically the only transportation option within SEA and Australia. Given the problems of loading machines onto such vessels, as well as the physical damages that often occur, it means that costs and lead-time until end-customer receives the ordered machine are increased. Another example is if the production of Motor grader was moved to South Korea from Canada, presuming that transportations were functioning without problems, approximately one month of transportation lead-time would be saved when transporting to Australia.

These examples are made to illustrate the importance of addressing the transportation problem more actively than today. We believe that there exists two possibilities for Volvo CE to improve its transportation possibilities within these regions in a more long-term perspective: either form a strategic alliance with a global shipping company, or acquire transportation services on a long-term basis from a major third-part company specialized in gathering and representing customers in negotiations with shipping companies. Volvo CE is currently acquiring such logistics services from freight forwarders in Singapore and Australia, but also from Volvo Transport on certain international routes except within SEA or down towards Australia. We therefore believe that a freight forwarder selection could be made among the currently used ones. Today, the freight forwarders in Singapore and Australia have mostly focused on finding available vessels on an ad-hoc basis. Volvo Transport, however, has already close relationships with the most important shipping companies in the world and represents large cargo volumes from other Volvo units. Therefore, they have important bargain power influence vis-à-vis shipping companies. It is reasonable to believe that a long-term relationship is to

interest of both Volvo CE, which would then reduce its transportation uncertainty, and to the partner in question.

We dismiss the option of chartering a vessel since the costs are too high at the sales volumes of Volvo CE in these regions. Consequently, the two options have their pros and cons. We summarize them in the following figure, 6.4.

	Strategic alliance with shipping company	***Long-term relationship wit major freight forwarder***
Advantages	+ Direct relationship with the shipping company. + Customization of transport routes.	+ High bargain power vis-à-vis the shipping company due to large cargo volume. + Scopes for customization of transport routes.
Drawbacks	- Requires large cargo volumes to be an interesting partner. - Low bargain power due to low cargo volume.	- Indirect relationship with shipping company. - Additional costs for the acquired services.
Outcome	= The particularities required by Volvo CE with its relatively low transport volumes are only moderately attractive in the eyes of a global shipping company.	= A major freight forwarder has the bargain power and cargo volume to entice shipping companies to transport on particular routes.

Figure 6.4 Potential logistics partners
Source: Our own

6.4 High inventory costs – revision of number of warehouses

Several authors point out that a revision of the number of warehouses could reduce costs and lead-time to the final customer. Today, Volvo CE has two warehouses in these regions that could best be described as distribution centers for each region. A warehouse is located in Sydney and another one in Singapore. In addition, dealers have machines on consignment in Australia. Singapore SC has no machines on consignment. Since the machines are held on consignment, the warehouse Volvo CE has is not really a warehouse, but it is a mixture. However, to be able to talk about number of warehouses, we will in this part treat the products held in stock, either at dealer's site or in the real warehouse, as one entity.

In Australia, the larger machines are held in stock, e.g. Wheel loaders, Articulated haulers, Hydraulic excavators and Motor graders. In Singapore, the mid sized to larger Wheel loaders and Articulated haulers are held in stock. We basically see three options: increase the number of warehouses, reduce to one central warehouse or keep two as today.

6.4.1 Increase the number of warehouses

The first option of increasing the number of warehouses poses rather good advantages. By locating warehouses closer to customers, Volvo CE will be able to supply customers with products faster. Another advantage is that they will show customers that they are committed to that particular market where they open up a warehouse. However, the disadvantages outweigh the advantages significantly. The main reason for this is that a new warehouse is really not needed. In the SEA market, Volvo CE could supply machines to customers when the volume was ten times bigger than today.

Another good reason for not increasing the number of warehouses in SEA is that all shipments from Europe and North America have to go through Singapore anyway. Singapore is the hub for Ro-Ro vessels to the SEA

market. Opening up another warehouse for the SEA market would mean that products have to pass Singapore anyway. Therefore, it would not be financially justified. In Australia, it could be argued that for instance Perth should have a warehouse, since they are situated somewhat in between Singapore and Sydney, but since the East coast has two thirds of the sales in Australia we do not think it is justifiable.

6.4.2 One central warehouse

The second option of reducing the number of warehouses to one poses an interesting question: which one of the two should then be closed? To answer this question, certain parameters must be compared. We have come to the conclusion that the following parameters are the most relevant ones for Volvo CE: transportation options, geographic location, taxes and customs procedures, transportation cost to port, cost of running warehouse, and customer proximity. The choice of these parameters was made by considering current theory and taking the particularity of Volvo CE machines into account.

Transportation options

Both Singapore and Sydney are large harbors, with Singapore being the larger one. Singapore has for a long time been the main hub for transportation in SEA, as almost all ships passes the harbor. The traffic going through Singapore is quite heavy and the harbor is perceived to be very efficient. The Sydney harbor has not the same amount of traffic and has not the same efficiency. To serve the Australian market, Sydney is the best harbor, but to serve the rest of the SEA market from here would be difficult. Singapore is the best harbor for supplying SEA, but transports to Australia are difficult to find. However, this could be solved if the volumes were bigger. In conclusion, it would be easier overall to ship machines from Singapore since there are more ships leaving from Singapore to the rest of Asia and Sydney than from Sydney to Asia and Singapore.

Geographic location

To serve these two markets, Singapore has the most central location. Singapore is close to all the major markets in the region, i.e. Indonesia, Malaysia, Thailand and Vietnam. Sydney, on the other hand, is located very far away from the center of these markets. Actually, Singapore could supply Perth in Australia approximately at the same speed as Sydney can, due to Australia's huge area. In this respect, Singapore has the best location.

Taxes and customs procedure

In Australia, the tariffs for bringing in Wheel loaders and Articulated haulers are 3%, Hydraulic excavators are duty free. However, if products are brought out of the country again, the tax is repaid. In Singapore, all products are brought in duty free. For getting the products through customs, Singapore is the fastest, not more than a day. In Sydney, the procedure takes approximately two days. Having Sydney as a central warehouse would cause extra work with arranging collection of paid taxes and it takes longer to get products to the customer. Therefore, Singapore is the winner.

Transportation cost to port

To Singapore from Sweden, Volvo CE pays USD 25 per cubic meter with Hyundai. To Sydney from Sweden, Volvo CE pays Wallenius-Wilhelmsen USD 83 per cubic meter. Between Singapore and Sydney the rate is approximately USD 50 both ways. This means that Sydney would be a more expensive place from which to supply products, to the two regions. Singapore is once again the preferred option.

Cost of running a warehouse

For the cost of running a warehouse we have no calculations, but according to our interviewees the cost would be 2-3 times higher in Singapore than in Sydney. This includes factors like renting the warehouse, labor cost, etc. However, the cost of running a warehouse is small compared to the cost of

holding an inventory, which is the same in Sydney as in Singapore. Anyway, Sydney would be the preferred option.

Customer proximity

Considering the locations of the warehouses for supplying customers, both warehouses have the best location in their respective region. Sydney is situated between Brisbane and Melbourne and together with surrounding areas these cities account for two thirds of Volvo CE's sales in Australia. Singapore, on the other hand, is very close to Indonesia, the largest market in SEA. When it comes to comparing the two, both locations are the best for their respective markets. However, since the Australian market is today three times bigger than the SEA market, Sydney will be a better choice.

Adding everything together

When adding all the parameters together, it becomes obvious that both warehouses have their advantages. It is safe to say that both are the best for supplying each region. If we have to choose one, Singapore is more advantageous, because of its better geographical location and better access to transportations. The vital importance of transportation for construction equipment was earlier described. Sydney would be very difficult to use for serving the customers on SEA markets. Using Sydney would also increase transportation costs significantly. The fact that sales in SEA are lower is very much a result of the Asian crisis. However, total market volume is expected to be doubled in the next 2-3 years. Before the crisis the volume was also higher in SEA than in Australia. Finally, even if the Singapore warehouse will be more expensive to run, that does not outweigh its advantages.

Implications

If Singapore were to be chosen as central warehouse, what would the implications be for Australia and Singapore? If we assume that a transportation route will be found or established (as suggested under heading 6.4.), vessels leaving once every other week, the lead-time to

Sydney would increase by anything between 10 – 24 days, depending on which vessel is found. If a secure route cannot be found, the lead-time would be even longer and much more uncertain. Moreover, since no Ro-Ro vessels with space are leaving for Australia at the moment, the likelihood of machines being damaged will increase when using the other vessel alternative, namely container ships.

Another implication is that the SC in Australia would no longer have any larger machines to show customers, since dealers cannot afford to hold these in stock. This would certainly decrease sales. The machine standard for Australia and SEA is not always the same and therefore the machines might have to be rebuilt to suite the Australian market. Furthermore, the size of the machines could mean that they have to be disassembled before shipping. Another problem that arises is the one of ownership. Who would own the products, the SC in Singapore, or the one in Australia, or both? If two SC's have a deal at the same time, which SC should then be the one that gets the product? We see a potential problem concerning ownership.

As it is the Australian warehouse that is supposed to be closed, we make this calculation from the perspective of the Australian market. To be able to make calculations on the effect of having one warehouse, certain assumptions must be made. Assumptions and how we established the result can be found in appendix 5. The calculation, expressed in Australian dollars[11], of having one central warehouse is found in table 6.1. This calculation is made for 1999.

Since it could be argued how much sales Volvo CE would loose if one warehouse was closed, we also made a calculation where we excluded this factor. Still, having only one warehouse would only mean a marginal positive financial result.

[11] 1 AUD = 0,633974 USD, www.xe.net./cgi-bin/ucc/convert, 10 December, 1999.

Cost reduction in holding stock	AUD 167,500
Change in transportation costs	AUD 77,500
Lost sales	AUD - 236,700
Rebuilding	AUD - 10,000
Extra handling Singapore	AUD - 229,700
TOTAL CHANGE	**AUD - 231,400**
WITHOUT LOST SALES TOTAL	**AUD 5,300**

Table 6.1 Calculation of having one central warehouse

Since the difference is only AUD 5,300 the break even point for a warehouse in Singapore to be profitable is when less than one machine deal is lost in Australia, when savings in inventory holding costs, extra handling costs and transportation costs are considered. In a long-term perspective when sales increase in SEA, the costs for rebuilding machines will increase and amount of lost sales will decrease. However, this does not change the problem with the extra handling costs that arise when transporting machines down to Australia from a central warehouse in Singapore.

6.4.3 Keeping current state: two warehouses

The final option of keeping two warehouses needs also to be discussed. Yet, can nothing be changed with this design? Changing the composition of the warehouse might be a possibility. We have used the warehouse in Australia to illustrate this. For instance, if Volvo CE only held one of the larger product series in stock instead of holding two or three, as they are doing today, maybe the result could improve somewhat. This calculation is found in appendix 6 together with the assumptions. However, this would only increase costs (see table 6.2).

The problem with lowering the inventory is that the transportation costs increase significantly, since machines have to be transported between

dealers. Inland transportation in Australia is also expensive, especially for larger machines. This is also true for SEA.

Cost reduction in stock holding	AUD 21,100
Change in transportation costs	AUD - 46,500
Lost sales	AUD -118,300
Extra handling costs	AUD -6,600
Total change	**AUD - 150,300**
Without lost sales Total	**AUD - 32,000**

Table 6.2 Calculation of changing composition in warehouse

6.4.4 Pros and Cons with different warehouse solutions

To illustrate the advantages and disadvantages of changing the number of warehouses, consider studying table 6.3.

	Increase in no. of warehouses	Two warehouses	One central warehouse
+	> Located closer to customers. > Able to supply customers swiftly.	> Able to make deals on both continents. > It is the most cost efficient alternative.	> Lower inventory holding costs. > Less costs associated with one warehouse.
-	> Very costly. > Transshipment needed in Singapore anyway.	> Slower supply of machines to customers compared to the alternative with more warehouses.	> Major loss of sales > Substantial extra in-land transportation and handling costs at port.

Table 6.3 Pros and cons with different solutions

6.5 Poor information handling

The reason for the inaccuracy in forecasting and long administrative lead-time is poor information handling. The information flow takes longer than necessary, which in turn prolongs the process of transporting machines and increases financial risks.

6.5.1 Information handling during the OTP process

Currently there is a wide range of non-value adding activities taking place within Volvo CE and in its contacts with external parties. There exist large scopes for improving the efficiency as to how information is processed and interpreted.

Placing an order

Today, when the dealer receives an order, he sends a fax to the SC, which in turn keys in the order in the MAS in Singapore or, in Australia, faxes the order to the PC. When the PC receives it, they check it to see that everything is in order and contact the shipping line for available vessels. This is quite an inefficient and lengthy process. The main problem is that the administrative work conducted by the SCs in the order process is not really adding any real value to the customer. What we think is needed is a new way of working.

A way to shorten the administrative lead-time could be to implement the MAS system at the dealer's site and at the PCs in Canada and South Korea that currently do not have this system. In addition to this, Volvo CE could create an online link with the shipping companies, enabling the order desk at the PCs to give a faster order acknowledgement. The change in order processing is illustrated in figure 6.5.

The benefits of these changes are lead-time reductions with probably four to five days. In addition, the people performing these activities at the SCs could be used for activities that create more value for the customers. If

customers were given a much faster order acknowledgement, they would be more satisfied with Volvo CE. The information regarding sales of machines would then be much better since everything is in the same system, reducing work of compiling data. This would ease the burden at the HQ. Finally, the Volvo CE objective of creating more Volvo share of mind at the dealer's site would also be improved.

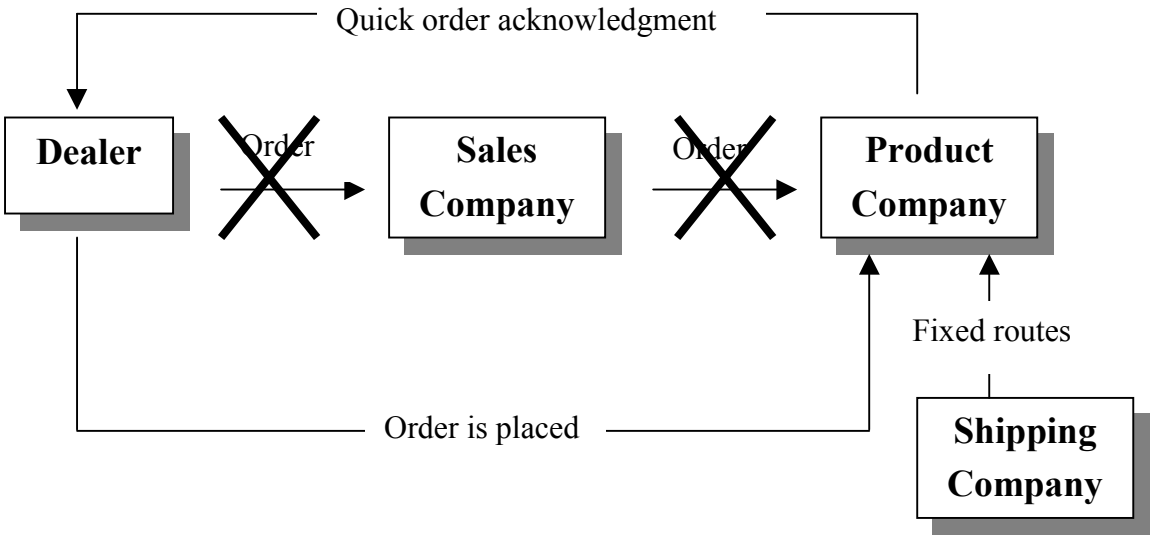


Figure 6.5 The 'new' procedure for placing an order
Source: our own

Another way of improving administrative lead-time could be to have pre-delivery information accessible online for the dealer, for example how long it would take before a product is available if an order is placed today. This would give dealers a much better opportunity to close a deal. This would also limit the current problem with the PC in Korea that is reluctant to give delivery dates on machines before an order is placed.

Furthermore, several interviewees have mentioned that the communication skills at the PC in Korea are somewhat insufficient. There also seems to be different views concerning the role of the PC and who the customer is.

Since the SC is ordering products from the PC, they are the immediate customers. There also seem to be a lack of service orientation of the Korean PCs towards the SCs. If the people dealing with the PC in Korea feel that they are not receiving the right support, they will become alienated against them, thus reducing an efficient way of working.

Finally, it is observed that Eskilstuna and Braås do not follow the policy of acknowledging an order within 24 hours. However, the order acknowledgments from Changwon or Goderich are far worse.

6.5.2 Forecasting

The importance of making a correct forecast was illustrated in the empirical evidence on pages 82-83. The financial impact of a forecast is actually quite large. Since the forecast drives production planning, both internal and external suppliers are affected by the forecast. This is especially visible in the supply of components where the PCs in Changwon and Eskilstuna are experiencing bottlenecks. Furthermore, having too much inventory for producing a machine will reduce the financial performance. The impact forecasts have on the monetary flow can actually be quite large. If currencies fluctuate and Volvo CE has not hedged enough, they will not be able to collect what they had planned to, and the result would be a poor financial performance.

To improve the forecasting, Volvo CE could develop better methods for the SCs and dealers to collect data on customer demand. Today, only subjective forecasting methods are used. The SCs within Volvo CE that make good estimates could be benchmarked to see why they succeed. By studying successful SCs, a common standard could be created for SCs and dealers. Volvo CE should also benchmark other companies that are better at making accurate forecasts. In addition, finding more objective forecasting techniques could improve forecasting. By adopting better forecasting techniques, Volvo CE should be able to make better forecasts.

By increasing forecasting accuracy, lower levels of inventory could be held at manufacturing sites. Suppliers will be better at supplying the right amount of components and raw material on time. Volvo CE lowers the financial risk by being able to hedge more than the 80% that they are doing today. SCs will also be better equipped for finding a good inventory holding strategy.

Spotting potential sales

To create flexibility in production capacity when sales increase or decrease some form of early warning system could be developed. For example, when dealers are 80% sure that they will make the deal, they send the information to the PC. This is something that could be done in the short-term forecasts, but is not done today. The systems exist but they are not used. Getting the dealer to make these forecasts could reduce lead-time significantly. In addition, the need for long-term forecasts could decrease.

6.5.3 A new way of handling information

Lost sales tracking

Today, it seems that none in Volvo CE knows how much sales Volvo CE is missing in Asia and Australia, for various reasons. To deal with this problem, a very simple web page for dealers could be constructed where they just print in three things if they miss a deal: type in machine(s) and model(s), how many, and finally the reason for not selling the machine, for instance price, long delivery time, not enough product support, etc. This should not take more than two minutes for a dealer to click in given categories. For dealers not linked with the Internet, a paper version could be created. In this way, the SCs could collect customer information very speedily and Volvo CE would be better suited to respond to changes on the market. The very late start of offering financing and other forms of soft products is a clear sign that Volvo CE does not have a quick and reliable way of collecting information they can react on.

Customer preferences

Interviewing dealers and managers at the SC in Australia, we discovered that there is quite a different view on who the competitors are. If the SC has one view of who the competitor is and targets the marketing campaigns toward exceeding that competitor's strong sides and the real competitor is another one, the marketing will not be very efficient. It is crucial to know who the competitor is in order to be able to compete efficiently. This also creates inefficiencies in targeting certain customers. By collecting more information of who the real competitors are and of the needs of the customers, Volvo CE could be better at targeting different customer segments.

Knowledge center

Today, the SCs collect much vital information for the different units within Volvo CE. However, it seems that all this information is not really transmitted. We think that the SC to a larger extent could share more information they collect with the HQ and PC. They could be the 'knowledge center' in the organization. In addition, the HQ could provide the SC with macro data and techniques for conducting better forecasts. This information the SCs could also share with dealers so that they are better attuned to how the economy is shifting and how that affects their business. More material on competitors and what their strategies are could also be given to dealers. Furthermore, the SC could educate dealers on how to make better forecasts. The changes in information handling are illustrated in figure 6.6.

A change in information handling would result in a higher Volvo share of mind at the dealer's site and in a better way of making information meaningful and available for all parties involved in the OTP process. Since the administrative lead-time would decrease, the SCs could have more time devoted to value adding activities.

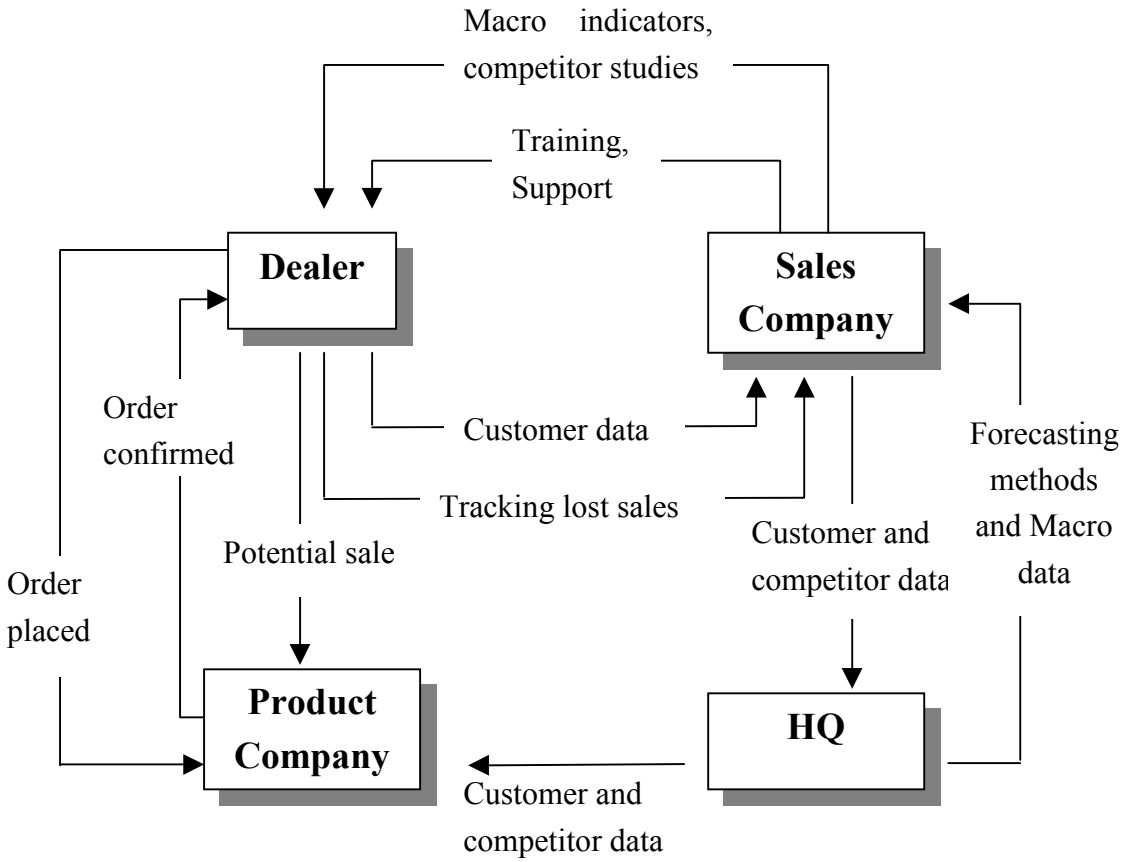


Figure 6.6 The 'new' way of handling information
Source: our own

6.6 Inappropriate organizational systems

The last underlying problem we have discovered is that the current structure of the PCs being the profit centers is not appropriate for serving the SEA and Australian markets efficiently. Given the particularities of transport possibilities of construction equipment in few numbers as well as the high lead-times for transporting machines within and between these markets, it becomes difficult to exploit business opportunities in these markets.

The implication of the PCs being profit centers is that the problems the SCs face, like low inventory levels and lack of competitive soft product offerings, do not receive enough attention since the PCs do not perceive these issues to be severe. The PCs are more concerned with giving their attention to producing reliable, high quality and productive machines. Hence, the focus on the product development is very strong compared to the after market. As we have discussed, the importance of soft products is not yet taken seriously compared to competitors like Caterpillar. Since the importance of soft products is growing it will be hard for Volvo CE to compete in the future.

For instance, if a Volvo CE machine performs better than that of competitors overall, but the time it takes to repair the machine when it breaks down is lengthy, the customer will lose faith in Volvo CE machines and choose competitor brands. At the same time, customers are looking at factors like financing, rental, used equipment, etc. Since Volvo CE does not currently offer any good solutions, they are losing sales. Devoting more resources to the SCs could change this. A way to do this is to change the SCs to become the profit centers of the organization, releasing more resources to the SCs.

Another problem with high transfer prices is that the SCs are actually contributing to the profit of the PCs. Since the SCs have to pay a rather high transfer price for products, the cost of holding an inventory becomes larger. Hence, the SC is tying up more resources than necessary. The PCs are optimizing their result at the expense of the SCs, which hurts the whole of Volvo CE. Taking a more holistic approach and lower transfer prices to the SCs could change this.

The low focus on customer demand can also be seen in how fast products are delivered to end customer. The strategy of holding low levels of inventory at dealers and SCs could only be achieved if production is close to customers and machines are manufactured immediately when they are

ordered. What we have discovered during our study is that the PCs in Braås, Eskilstuna and Changwon are working with a philosophy of holding as low inventory as possible of components and raw material. However, in Eskilstuna interviewees mentioned that there were bottlenecks in supplying components resulting in delayed production. In addition, the transportation time from Sweden to Singapore and Sydney with 25 respectively 35 days overseas makes lead-times to the final customer very lengthy and non-competitive.

To deal with this problem there are basically two ways: increase the inventory or manufacture closer to customers, i.e. source more products from the plant in Changwon. Having large inventories and local manufacturing are the preferred strategies by Caterpillar and Komatsu. As Caterpillar and Komatsu have larger volumes, Volvo CE will have difficulties to compete on the same conditions. Caterpillar and Komatsu are able to turn their inventories faster due to larger volumes, even if they are holding more models than Volvo CE. Thus, Volvo CE increasing its inventory will not lead to a competitive advantage, but more likely to poorer financial performance and a higher risk.

In that respect, sourcing more products from Changwon factory will instead be a better option. This is the strategy proposed by Volvo CE, and they recently started to produce Articulated haulers in the Changwon factory. However, this transition will take years and to stay competitive during that time, the SCs might need to hold an inventory to stay competitive. For SCs to be able to hold a larger inventory without increasing costs, transfer prices could be lowered between PCs and SCs.

Since the SCs do not have any direct incentive for making correct forecasts today, a change in responsibility might be needed. Making SCs more responsible for forecasting, by giving them a larger share of the profits made, they will become more sensitive to find the right volume. In addition, SCs will be less opportunistic in bargaining for products since

each unit is not to be sub optimized. Rather the whole internal supply chain could be optimized.

What might be needed is better harmony between units within Volvo CE and of how profits are divided. To make Volvo CE more competitive on these markets a change in the organization structure could alter this. A way to make Volvo CE more competitive is to move the main profit center from the PCs to the SCs. The benefits with SCs as profit centers compared to the current structure are illustrated in figure 6.7.

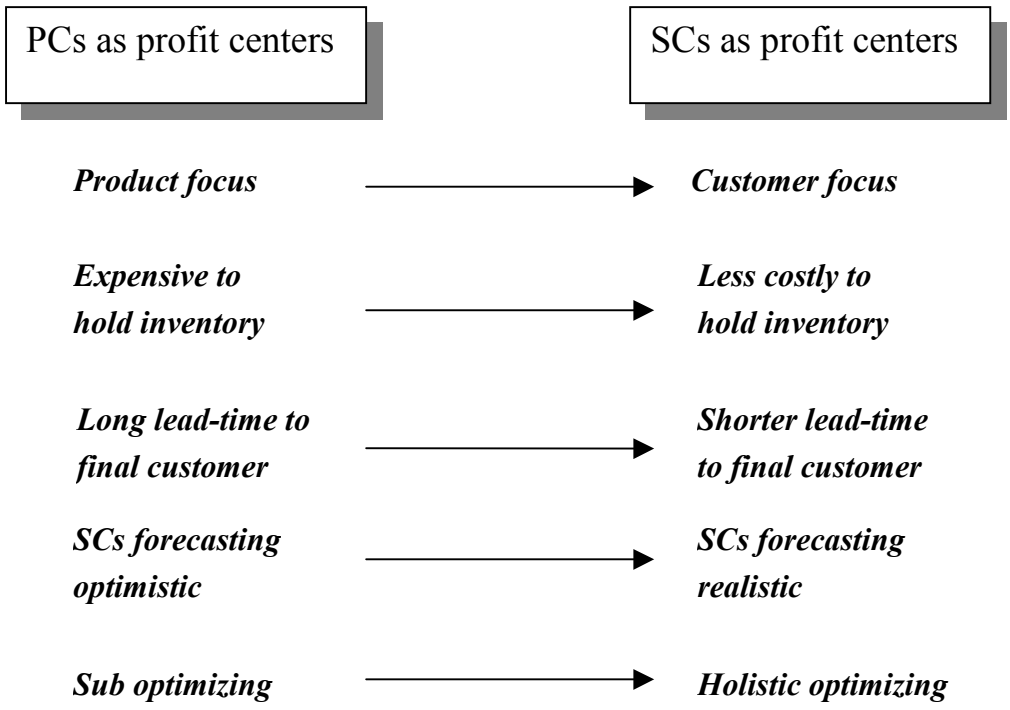


Figure 6.7 Benefits of making the SCs profit centers
Source: Our own

7. CONCLUSIONS – OUR CONTRIBUTION TO SCIENCE

In this chapter we will present our theoretical findings. Since we have discovered during our study that certain areas that we had delimited us from have a significant impact on how a company is performing, we will to a certain extent include these factors. First, we will make a comparison of the reality with current theories. A model will follow that presents how a company, by managing the order-to-payment more efficiently, can become more competitive.

7.1 Theory vs. Reality

When comparing the theories and models used with the data collected, we have made some interesting findings. Since several of the theories used were originally based on consumer goods related cases we have made some comparisons, based on our findings. We think it is important to show these differences since many authors too often generalize about the logistics issues. To understand how different the logistics are for heavy equipment it is compared to the more commonly described consumer goods (consider studying table 7.1).

To start with, the business of selling consumer goods compared to heavy equipment is very different. Customer characteristics, for instance, differ significantly. In addition, heavy equipment is sold on few locations by dealers, while consumer goods are sold on a large variety of locations. When it comes to the logistic side of comparing the two, a big difference is noted between what is possible when transporting consumer goods compared to construction equipment. Not only are there options when transporting consumer goods, but there are also trade-offs that can be made between air and sea transportation. This is mainly because consumer goods are, in general, not bulky or heavy.

	Consumer goods	Heavy equipment goods
Transportation	- Several options. - Trade off between sea and air possible. - Relatively inexpensive.	- Few options. - Sea only viable option. - Relatively expensive.
Inventory	- Possible to hold low inventory levels without affecting sales.	- Difficult to hold low inventory levels without affecting sales.
Order information	- Little information needed.	- Extensive information needed.
Goods sold	- Many locations.	- Few locations.
Product Characteristics	- Mostly standardized.	- A mix of customization and standardization.

Table 7.1 Consumer goods vs. heavy equipment goods
Source: Our own

When it comes to holding an inventory, it is obvious that in the heavy equipment industry, it is very expensive per se. As a consequence, dealers are reluctant to carry an inventory, which has an impact on sales, especially the lead-times from when an order is placed until the customer receives the machine. Retail chains, on the other hand, can with sophisticated systems like ECR hold very low levels of inventory in terms of capital. Instead, retailers replenish their inventory stock very often. This is not possible for heavy equipment sold more seldom. Such sophisticated systems would only have a marginal effect. Other factors are more important to monitor, for instance the information.

The information that follows an order is quite different for heavy equipment compared to consumer goods. Take for example an order of an excavator, which has many options. Thus, there is a high degree of customization. In addition, there are numerous attachments to choose from. Compared to consumer goods that normally are quite standardized, the

information needed when ordering is rather simple. Finally, consumer goods are sold at numerous outlets, making transportation more complicated. Heavy machinery is instead sold on few locations. However, transportation to customers in remote places can be very complicated.

In addition to this comparison, we have made some interesting empirical findings. The first one is probably how strong a first mover advantage can be seen in reality. Caterpillar has a 30% market share worldwide, but they truly dominate the industry. The reason for this is that they are able to create economies of scale in most of their activities. The most interesting thing to note is that they keep their first mover advantage. Since Caterpillar is continuously introducing new products/product lines and services, they are able to hold on to their initial first mover advantage.

Secondly, an interesting discovery we made was that consignment is not really discussed in traditional theory as an option for holding an inventory. This is probably a result of the heavy focus on retail industry, where holding an inventory is not very expensive. We found that sales on consignment is a good solution for helping several dealers to promote more sales.

Thirdly, we found in our study that there is not really any focus on lead-time within Volvo CE to improve efficiency, as described in theory. The focus is rather on costs to be saved within different logistics activities. Lead-times are more seen as a variable to monitor if customers want faster deliveries, not a way of saving costs. This is to be contrasted with time-based distribution theories, whose proponents argue that monitoring lead-time could render major cost advantages.

Fourthly, that forecasting becomes more difficult when it crosses boarders is confirmed, although this is hardly a surprise. Yet, what is interesting is that Abrahamsson and Brege argue that flexible manufacturing should mean less forecasting. This may be true for a company that produces for a

smaller domestic market or close neighboring countries, but not for distant markets. As we have seen, both Eskilstuna and Braås have quite flexible manufacturing, yet they are still very dependent on forecasts in order to be able to plan their production.

Finally, it is confirmed that making relationships with external actors is important to be successful. We think our findings correspond very well with the theories in supply chain management. However, we have not seen any real proof that Volvo CE or its suppliers work in a process-oriented manner, and they are still more functional-oriented.

7.2 Holistic competitive advantage

To answer our main problem "*Considering the globalization of markets, how does an MNC, operating in the heavy equipment industry, enhance its competitiveness by more efficiently managing its order-to-payment process, when manufacturing and markets are located at long distance apart?"* - we have constructed a model labeled 'Holistic Competitive Advantage' (see figure 7.1). As the name implies, we think a company can only achieve a competitive advantage if it takes a holistic approach to its business activities. What we suggest is not a one-time solution that a company can use when they face problems. On the contrary, this is an on-going process, where excellence is the aim.

Customer analysis

The first step in becoming more competitive is to make an extensive analysis of what customers require. We think it is vital that all business starts with a focus on the customer. This might be obvious, but even today there are companies that still focus primarily on pleasing other stakeholders within the organization, for instance manufacturing. The problem with that approach is that the company eventually manufactures products none wants to buy. If there is no market, no products will be sold even if the products can be of excellent quality.

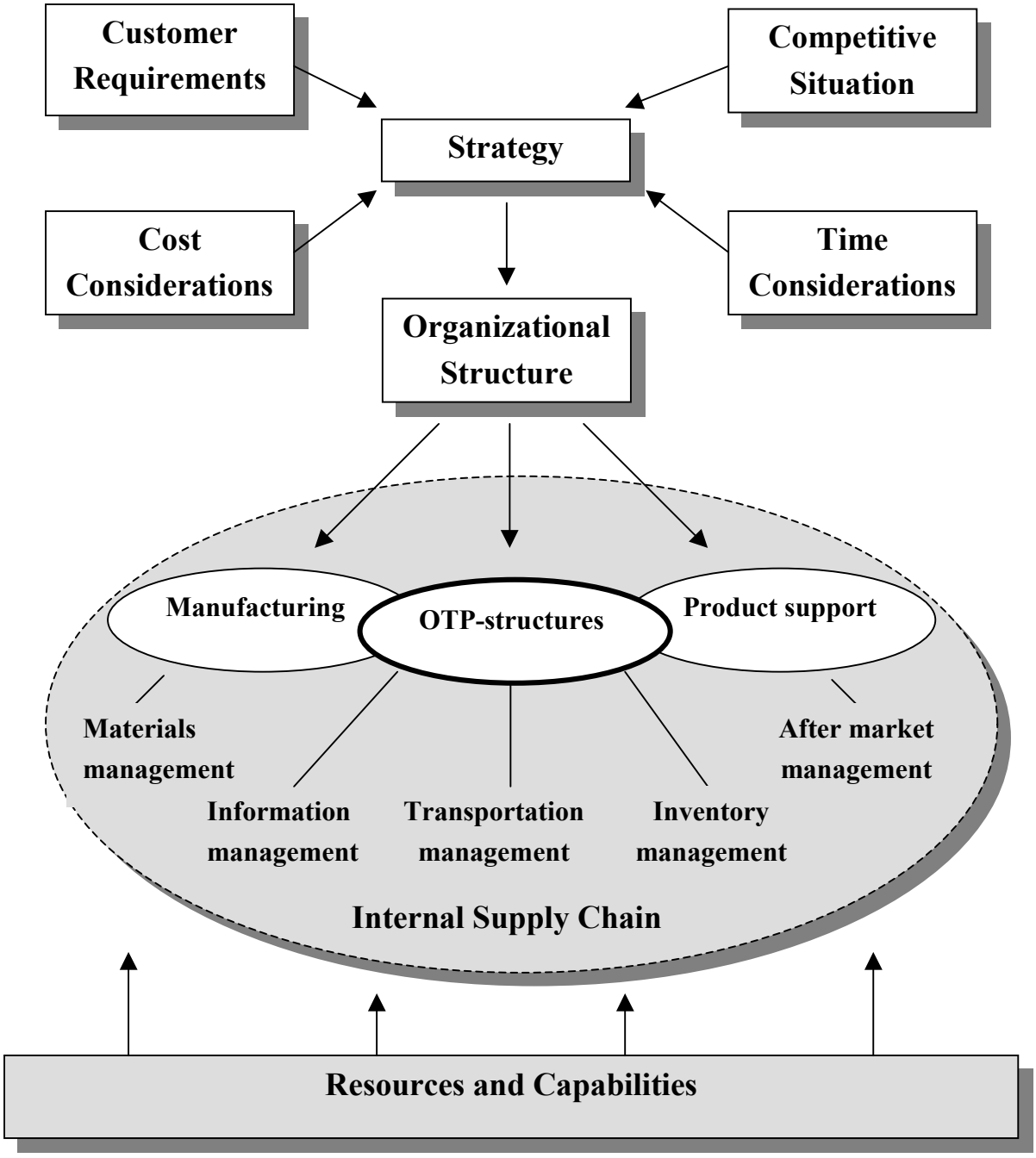


Figure 7.1 Holistic Competitive Advantage

Furthermore, we use the term 'customer requirements' instead of the more commonly used term 'customer needs'. The reason for this distinction is that there is quite a big difference between what customers need and what they require. A customer may need many things, but there are a few things

that the customer requires. Determining these requirements is vital. The analysis should also be future-oriented, trying to identify future requirements.

Competitor analysis

The next step is to make an evaluation of the competitive situation. A way to do this can be to pose different questions of what the competition is doing. More basic questions could be: What are competitors offering? What are competitors' strengths and weaknesses? How are competitors competing needs to be posed? In addition, there are more complex questions: What are the competitors' strategies and goals? What are competitors' resources and capabilities? What needs to be done to get a competitive advantage? These questions need to be addressed. By making an extensive analysis of the competitors a company should be able to determine what the key success factors in the industry are.

Cost and lead-time considerations

When conducting these analyzes, time and cost considerations must also be made. Finding the right cost and time level might be difficult. For example, determining how much a customer values getting a product delivered five days faster is very difficult to assess. Instead, using reductions in lead-time as a way of reducing costs will be more efficient. Reducing lead-time and at the same time reduce costs is actually possible as we illustrated earlier. It is a matter of being creative and finding ground-breaking solutions.

Strategy formulation and implementation

By considering these issues a strategy should be formulated, which in turn must be communicated to the organization. We agree with Prahalad that creating a strategy is very much about creating a new marketplace. The strategy must stretch beyond the current boundaries, breaking new ground. This could mean entering new market segments or offering new products. It is important in this process to link incentives and rewards so that they are aligned with the strategy. The structure in the organization should also

underpin the strategy; otherwise the strategy could never be successfully implemented. The top management must make sure that management philosophies are consistent, since it is the management that is going to implement the strategy. What we mean with a consistency in management philosophies is that actions taken in, for example, production should be aligned with what is required in inventory holding policies, customer requirements, etc.

Holistic thinking

To get minimum impact of a change there must exist an organizational structure that supports it. The organization should be organized around processes instead of functions. The problem with functional organization is that people maximize their particular function without considering other functions. The result is low interdependency between functions and therefore different units act more in a sub-optimized manner than from a holistic perspective. There are scopes for improvements if an organization organizes its activities around processes. In that way, the entire span of activities has more of a customer-oriented perspective. It is crucial in this process that management takes a holistic approach to the decisions they make. There must also be room for incentives for managers that make these considerations. Rewards and incentives must be aligned with goals of improving the whole internal supply chain.

Internal supply chain

In what we label ’Internal Supply Chain’ there are several things that need to be monitored. The core is the OTP structures, i.e. the product, information and monetary flows that run through a company. The aim should be to improve the process so that costs and lead-times is kept at a minimum. Making beneficial trade offs are the key to success. For instance, if costs in manufacturing increase but the cost for holding finished goods inventory decreases to the extent that the overall cost is reduced, major advantages could be made. Thus the company would be able to take a truly holistic perspective on the activities.

Manufacturing and product support

In addition to the OTP structures, manufacturing and product support must be incorporated. Having a reliable and timely supply of products is vital in order to be able to have an efficient OTP process. Product support also plays an important part since it is the link to the customer and dealer during and after the deal is complete. By offering excellent product support, the dealer will be able to keep the customer happy, thus securing future sales.

Managing the internal supply chain

To make this internal supply chain work smoothly, certain activities must be structured and monitored. The first one is the materials management. Arranging a proper inventory of raw materials and components is crucial for speedy and reliable manufacturing. For instance, using a JIT philosophy requires that products be manufactured on a JIT basis, not only that raw materials and components are stocked at a minimum. To be able to take full advantage of the JIT philosophy, the whole supply chain must be flexible enough to shift when customer demand shifts. Considerations must be made to see to if that end-customers do not suffer from long lead-times in cases where inventories are held at minimum levels. Secondly, information management must be addressed. The information flowing through a company is not merely the oil in the machinery; it is what levers a competitive advantage. By structuring and interpreting information it can be much more useful. In this process, making information available and transparent for all parties is the key to success. Thirdly, arranging transportation for heavy equipment is a question not only of finding good routes, but also of being proactive when necessary and taking initiatives for new routes by working closer with shipping companies.

Fourthly, having the right level of inventory is crucial to be able to compete. A revision of the number of warehouses, the locations, and the costs associated is normally sound. However, finding new cost efficient ways like renting a warehouse or having machinery on consignment at

dealers site could be another way of becoming more competitive. Finally, being able to supply customers and dealers with the right after market support is not only important in order to keep customers but is nowadays also a prerequisite for making the deal. Being able to offer good financing, quick repair when a machine breaks down (they all do once in a while) and a good second hand market is vital for customers. Thus, customers are taking a holistic approach to the deal.

To make all these activities come together a holistic approach must be taken. Without a consistency in these activities, a company will not create a competitive advantage.

Resources and capabilities

Underpinning the internal supply chain are the resources and capabilities within the company. Strong brands and technology that is hard to imitate are resources that strengthen the processes in the internal supply chain. However, the most powerful resource is the people's skills and knowledge in the organization. When all these resources come together the company can lever its organizational capabilities. However, we think that a company should improve the capabilities needed to become successful, not only exploit those that they are already good at, as traditionally literature argues. The capabilities that are the most important ones to manage are the five activities described in the previous section.

External supply chain

Surrounding the internal supply chain is the external supply chain, i.e. the relationships with suppliers and intermediaries of different kinds. Making these external providers closer to the company is the final way of becoming more competitive. By finding new and customized solutions for the company, they can render advantages that the competition cannot imitate.

Through working continuously on improving these processes, activities and relationships that a company in the heavy equipment industry can, we believe, create a competitive advantage.

8. RECOMMENDATIONS

In this last chapter we will present our recommendations to Volvo CE. How to go about implementing these recommendations will be discussed. Finally, our suggestions for future research will complete this master thesis.

8.1 Five recommendations to Volvo CE

The research problems that we posed in the introduction are now to be answered. The first research problem was:

How can the distribution of bulky products to customers in SEA and Australia become more cost efficient?

That was followed by a second research problem:

How can a better administration of information reduce lead-times and financial risks in a company?

To answer these research problems, we have summed up our answers into five recommendations. First, we would like to comment on how the research problems are connected with our recommendations. Recommendations 1, 2, 3 and 5 are concerned with research problem one. Recommendations 3, 4 and 5 are concerned with research problem two.

1. Address the missing link in the Korea hub concept: transportation

If Korea is to become the strategic hub, supplying customers within the Asian continent and down towards Australia– particularly in the long run when sales volumes are supposed to increase significantly and more product ranges are being assembled in the Changwon facility –

transportation to these markets must be addressed. As we have shown, transportation is a major bottleneck, with shipping companies refusing to carry Volvo CE machines. Since several people we interviewed have argued that the transportation problems are outside the reach of Volvo CE, we believe that there is a need for moving transportation up on the corporate agenda. Otherwise lead-time will be as lengthy from Korea as from Sweden to these markets. What needs to be changed is that Volvo CE changes from having a *reaction* strategy, and instead incorporates an *action* strategy. We would recommend Volvo CE to establish a closer relationship with a global freight forwarder with substantial cargo volumes that could help in the negotiations for a new transportation route with a Ro-Ro vessel company that covers Volvo CE's needs in these regions. The outcomes would be shorter lead-time, increased sales, reduction in costs and better customer service.

2. Stay with two warehouses

We believe that today's structure of two warehouses is the most cost-efficient one under current circumstances. Our calculations show that closing one of the warehouses would have a negative impact on the financial performance and lead to a significant loss of sales. Closing one of the warehouses could only be done when and if dealers carry a complete line of machines themselves. The problems of finding convenient transportation make it more costly and increase lead-times if only one warehouse was to serve both markets in SEA and Australia. Therefore, the only viable option is to keep two warehouses. An increase in the number of warehouses is not necessary at the moment, but may be required when some of the Asian countries grow in importance like China or India, where in-land transportation might be a problem.

To improve the currently low service levels and reduce costs, Volvo CE should focus on reducing lead-times rather than changing the level of inventory. Our study shows that Volvo CE couldn't compete cost

efficiently by holding stock; so therefore the only way to compete is with shorter lead-time than its competitors. The result will be that Volvo CE can compete on the same or even better conditions as Caterpillar and Komatsu. We believe that by competing on time Volvo CE will create a competitive advantage.

3. Reorganize information handling

Reorganizing information handling could be done in a variety of ways. As our study shows there are several shortcomings in the way information is managed. We believe that fast order acknowledgement, lost sales tracking and sharing of information throughout the internal and external supply chain are the best alternatives for improving information handling. The order-handling procedure should to a larger extent be made directly between dealers and Product Companies than today. Sales Companies resources can be more specifically directed towards value-adding activities. The result would be better customer service, higher Volvo share of mind at the dealers' site, and resources being better utilized within the organization for creating value-adding activities for customers.

4. Release the knowledge within the organization

We would like to see the Sales Company not merely being a support unit; it should be the knowledge center of the organization. The focus should be on supporting and training dealers, collecting customer data and providing information to other units within Volvo CE. At the same time, we would like to see Volvo CE organized around processes instead of functions. If Volvo CE eliminated the non-value adding activities we discovered and instead used the resources in concordance with our recommendations, they could render substantial benefits. Altogether, the outcome would be that Volvo CE would compete with superior knowledge, and be able to provide better solutions for its customer than competitors would.

5. Make the Sales Companies the actual profit centers

Our study shows that several of the problems that occurred in the order-to-payment process could be directly linked to the Product Companies being profit centers. The most apparent ones are the high costs of holding an inventory, small incentives in making forecasts and a lack of customer focus. What we would like to see is a shift in power where the Sales Companies get a larger share of the profits, thus lower transfer prices. The outcomes are that holding an inventory will be less costly for the Sales Companies and customers could be supplied faster. In addition, with lower transfer prices more resources would be allocated to the Sales Companies, enabling them to supply customers with better offers beside the core products as financing, spare parts, product support, etc. Finally, by giving the Sales Companies a larger share of the profits, they will devote more time and resources in finding the right volume of demand, and this several times a year. This would reduce financial risks and inventory holding costs at the Product Companies.

However, changing transfer prices seems simple in theory, but we know that in reality this has far more implications than we have stated. Therefore, we would recommend Volvo CE to look more closely at this issue and its implications.

8.2 How to implement the recommendations

Since we recommend many changes, an important question arises: How to manage change? We believe that it will be difficult and daunting to change the current way of working. Staying with the well-known is always easier than questioning current structures. In this change process, we think the following issues are important to focus on:

- Change incentives and rewards so they are aligned with goal/strategy. Performance measures need to be changed. Employees should be evaluated and rewarded according to new criteria like customer satisfaction levels, lead-time reductions, order

acknowledgement time, improvements in creating efficiencies in the internal supply chain, etc.

- Change the current functional structures into processes. Not until the supply of machines is perceived as a flow where different actors participate and each and every action has an effect on the final output, will there be a true improvement. Taking a holistic view of the company is crucial in order to achieve profound results. What is needed is that the organizational structure is aligned with the internal supply chain.

- Finally, we believe that a continuous up-grading of the information technology system should be done. At the same time, including external stakeholders in the supply chain would increase the efficiency. This would allow, for example, dealers to obtain faster information regarding production schedules or departure dates of vessels. Creating more efficient ways of working with information will reduce administrative lead-time, and the people in the organization will be better equipped to meet customer demand and competitive pressures. Thus the resources and capabilities in the organizations will be better utilized.

8.3 Future research for Volvo CE and academia

To end this thesis we will discuss the possibilities to apply our study from other perspectives. This will be followed by some suggestions for further research that we think is both interesting to Volvo CE and to academia.

8.3.1 Different case study perspectives

Since this case study could have been carried out in a variety of ways, we think it would also be informative to present some alternative ways that in retrospective would be interesting. Firstly, this study could have been

conducted as an *organizational learning study*. There are several major changes Volvo CE is presently facing. How to manage these changes in the organization in order to become more competitive would be interesting to study from an organizational learning perspective. Secondly, the importance of keeping *good relationships with external actors* is increasing in the heavy equipment industry. To become more competitive, several actors have started to interact more closely. For instance, Komatsu is using a joint venture approach to gain access to markets and knowledge around the world. It would have been interesting to study how Volvo CE could strengthen its relationships from a *network perspective*. Finally, the way *financial risks and opportunities* are dealt with in Volvo CE could be fruitful to study. For instance, financing to dealers and customers has become a major competitive measure in the industry. It would be fruitful to understand the full implications of the risks as well as the competitive benefits.

8.3.2 Interesting areas of study

In the quest for finding new and better ways of competing, we think the following research questions would be interesting to study further:

Spare parts

This is an area that most interviewees talked about during our study. There seems to be a large scope for improvement in this area. However, at a request from Volvo CE we did not study this further, but we think it is vital for Volvo CE to study this area. Here exists a major opportunity for becoming more competitive. Since spare parts are one of the components in the concept of soft products, we have earlier mentioned that there exists a large scope for improvements. To academia it would be interesting to study what the implications are when the core product is decreasing in value for the surrounding services.

The benefits of E-commerce

During our study we have seen many opportunities can be gained from an e-commerce solution, especially in handling information more efficiently. For instance, this solution could reduce language problems between different units. In addition, selling machines in the price competitive Asia through a web site could lower prices significantly. At the same time, standardized machines could be the only option to lower production lead-time. In competing with Caterpillar, this might be a new way of creating a competitive advantage since Caterpillar would never bypass its dealers.

Since there has been some pressure on the customers to lower their costs, a Volvo CE web site selling machines could be attractive if machines were sold at a lower price than at the dealer's site. However, we think this might be too early to implement at the moment, but it is definitely an area to explore for the future.

Flexible manufacturing

We have merely touched upon manufacturing issues in this thesis. However, finding more optimal solutions when being located from distant markets is a vital issue for companies with distant manufacturing. What we think would be interesting to study is how a company producing relatively large and complex machines can move production closer to the end-customer. Opening up a new factory might not be the only way. How to work around modular manufacturing, like several truck companies are doing with local assembly, might be a way. In Volvo CE, for instance, major components are produced in Eskilstuna for manufacturing facilities around the world. For Volvo CE this would be especially interesting, since customers often change specifications on an order when it has already been produced and shipped.

It would also be interesting to study flexible manufacturing as a measure of distributing products faster to the market, i.e. increase the pace of new products and product development.

Implications of using external providers when crossing borders

Finally, we think it would be interesting for academia to study the implications for external providers, e.g. suppliers, when crossing borders in the heavy machinery industry. Today, there is a trend in larger MNCs, for example, car manufacturers, to demand their suppliers to open up manufacturing in the MNC's new market, otherwise the supplier loses the contract on the domestic market. We have not studied this in relation to Volvo CE, but we think it is an interesting subject that is closely related to the concept of supply-chain management. As far as we know, this has not been studied from a logistics perspective.

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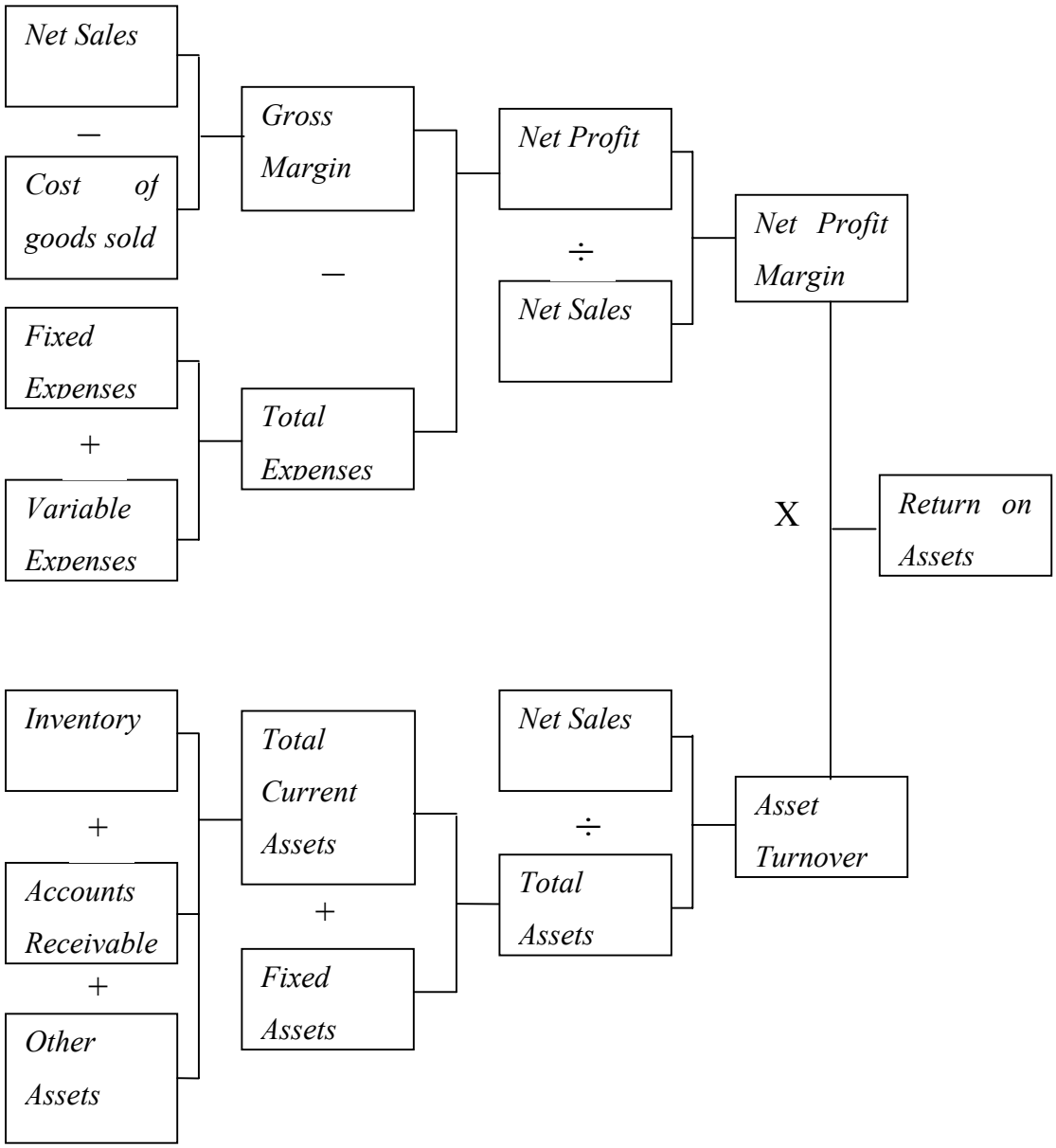
Appendix 1

School	View of strategy
The Design School	*Strategy is seen the formation of achieving a fit between internal strengths and weaknesses and external threats and opportunities.*
The Planning School	*Resembles the design school but emphasizes that the process of strategy should be formal and taken in distinct steps.*
The Positioning School	*Strategy is the selection of a generic position through formalized analyses of industry situation.*
The Entrepreneurial School	*Strategy is seen as visions, perspectives or metaphors.*
The Cognitive School	*Strategy is looked upon from its origin, i.e. how strategies develop in people's minds.*
The Learning School	*Strategies are seen as emergent, where formulation and implementation are intertwined.*
The Power School	*Strategies are seen in the political context where they are created, both within the company as well as with other organizations.*
The Cultural School	*Strategy is the formation of social processes rooted in the culture.*
The Environmental School	*Strategy is concerned with how an organization is able to use their freedom to create a strategy in accordance with its environment.*
The Configuration School	*This view sees strategy as a configuration of coherent clusters of characteristics and behaviors in the organization.*

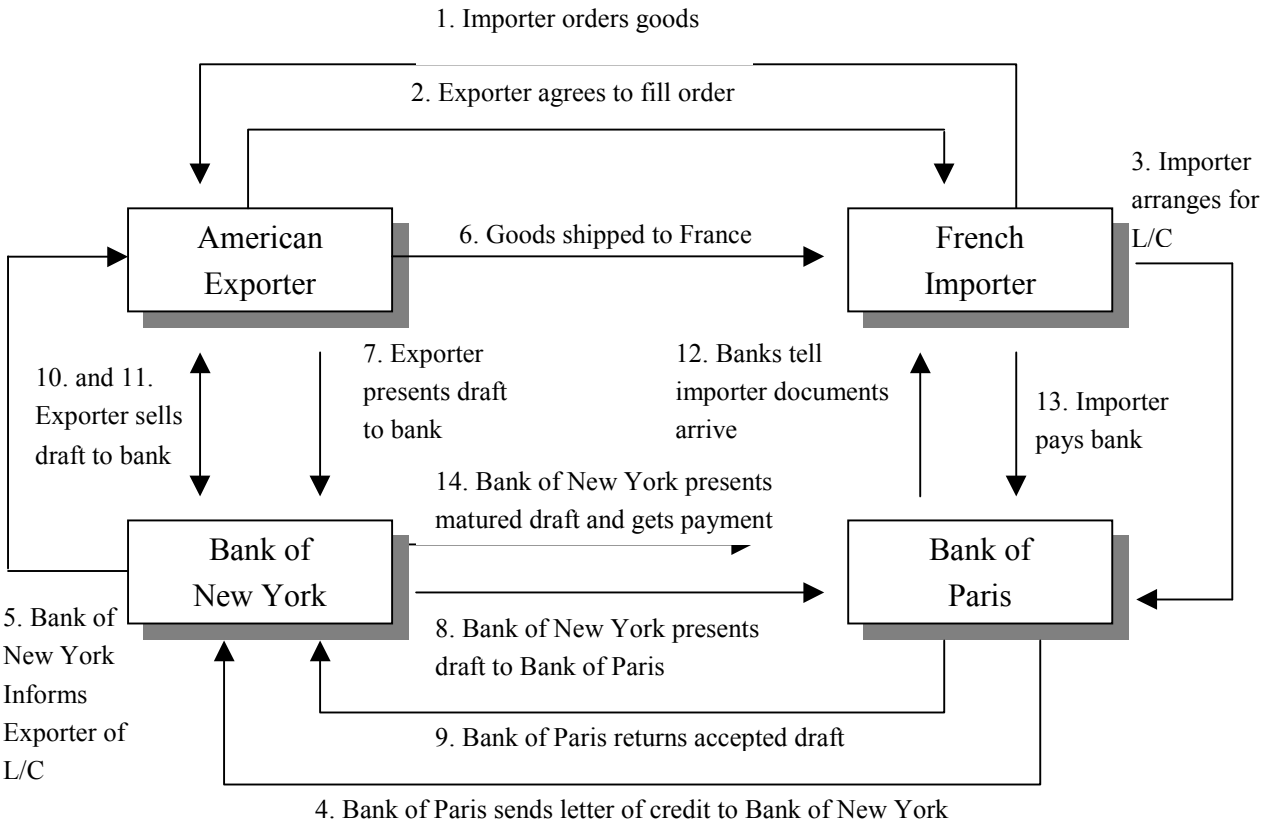
Appendix 2

The net profit margin is a measure of a company's overall performance. It is built up by the net sales of the company, cost of goods sold, operating expenses, taxes and interest expenses. The asset turnover ratio is a measure on how effectively a company uses its assets. The company's current assets, fixed assets and net sales determine the turnover ratio. These two ratios leads to the return on assets ration that shows how much profit that can be generated from the company's investment in assets see figure.



Appendix 3

Hill (1998) gives as an example of an international transaction involving an exchange between a French importer and an American exporter. The transaction has the following 14 steps:



1. The French importer places an order with the U.S. exporter and asks the American if he would be willing to ship under a letter of credit.
2. The U.S. exporter agrees to ship under a letter of credit and specifies relevant information such as prices and delivery terms.
3. The French importer applies to the Bank of Paris for a letter of credit to be issued in favor of the U.S. exporter for the merchandise the importer wishes to buy.
4. The Bank of Paris issues a letter of credit and sends it to the U.S. exporter's bank, the Bank of New York.

5. The Bank of New York advises the U.S. exporter of the opening of a letter of credit in his favor.
6. The U.S. exporter ships the goods to the French importer on a common carrier. An official of the carrier gives the exporter a bill of lading.
7. The U.S. exporter presents a 90-day time draft drawn on the Bank of Paris in accordance with its letter of credit and the bill of lading to the Bank of New York. The U.S. exporter endorses the bill of lading so title to the goods is transferred to the Bank of New York.
8. The Bank of New York sends the draft and bill of lading to the Bank of Paris. The Bank of Paris accepts the draft, taking possession of the documents and promising to pay the now accepted draft in 90 days.
9. The Bank of Paris returns the accepted draft to the Bank of New York.
10. The Bank of New York tells the U.S. exporter that it has received the accepted bank draft, which is payable in 90 days.
11. The exporter sells the draft to the Bank of New York at a discount from its face value and receives the discounted cash value of the draft in return.
12. The Bank of Paris notifies the French importer of the arrival of the documents. She agrees to pay the Bank of Paris in 90 days. The Bank of Paris releases the documents so the importer can take possession of the shipment.
13. In 90 days the Bank of Paris receives the importer's payment, so it has funds to pay the maturing draft.
14. In 90 days the holder of the matured acceptance (in this case, the Bank of New York) presents it to the Bank of Paris for payment. The Bank of Paris pays.

Appendix 4

A framework for analyzing logistics and supply chain cases

Taylor (1997) has developed a framework consisting of five steps for analyzing and solving a logistical problem, see figure 1. This framework will be used as a structure in our analysis. However, since Taylor does not go into depth in certain areas, we will incorporate other theories and models as well, developed in the theoretical framework.

Step 1. Situation analysis

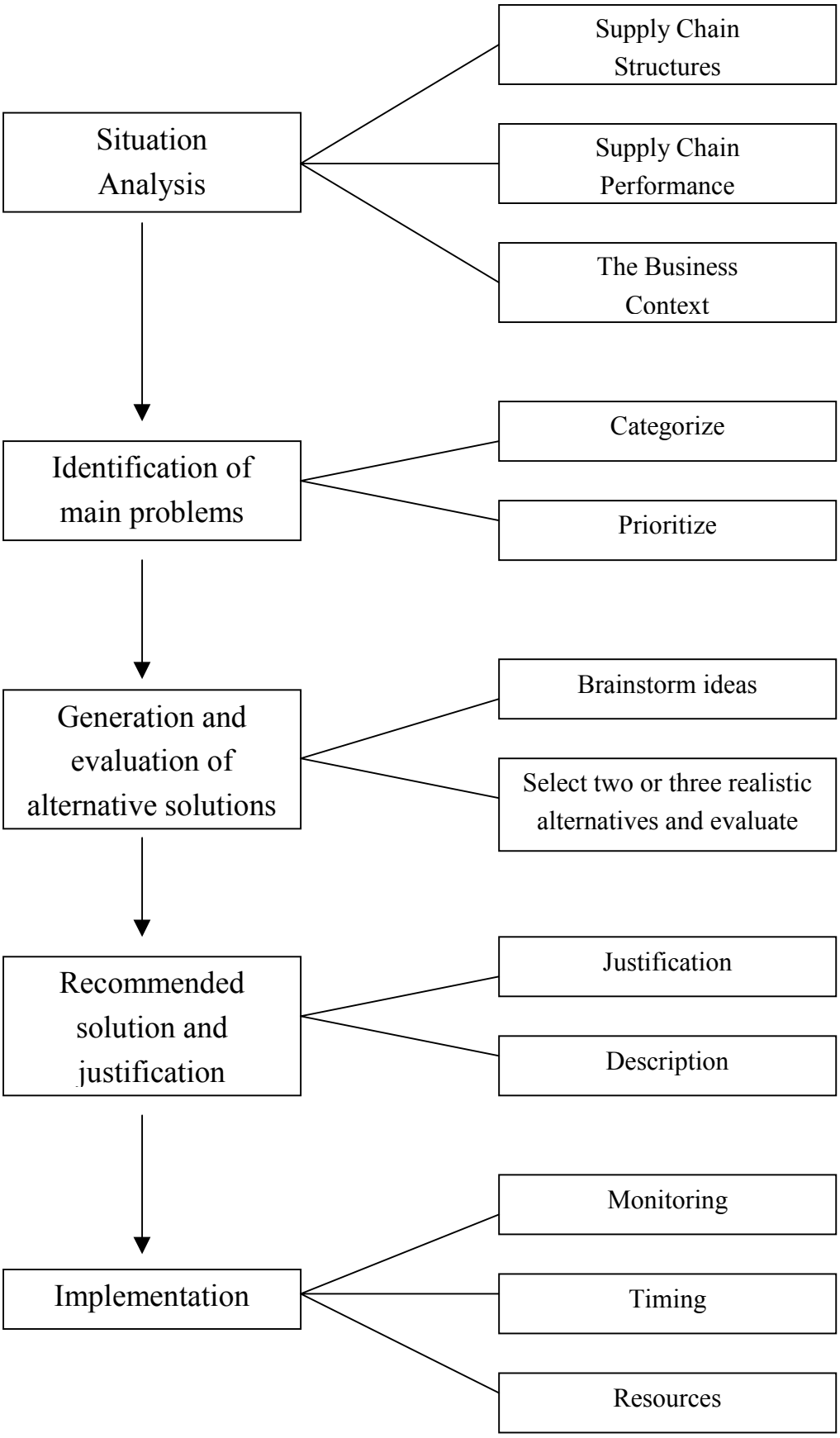
The first step is to make a situation analysis that focuses on the structures and performance of the supply chain in context of the business environment. Since this is the most important part for our thesis, we will go deeper into this step.

Supply chain structures

Taylor addresses as Hoover et al (1996) the importance of flows of products and information when studying the processes in the supply chain. Although he adds another dimensions, the organizational and management structures that control the supply chain. According to Taylor there are three major issues that needs to be considered when analyzing problems in the supply chain:

The physical flow of goods

When analyzing the physical flow of goods, the starting point is to analyze the company by mapping the flow of goods from the sourcing of raw materials or components, through manufacturing and out through the distribution channel to the end customer. During this mapping it is important to focus on two things. Firstly, focus on the fixed points in the chain, meaning that one should try to categorize the various functional stages in the supply chain, e.g. manufacturing, warehousing, retailing etc.


Situation Analysis
Supply Chain Structures
Supply Chain Performance
The Business Context
Identification of main problems
Categorize
Prioritize
Generation and evaluation of alternative solutions
Brainstorm ideas
Select two or three realistic alternatives and evaluate
Recommended solution and justification
Justification
Description
Implementation
Monitoring
Timing
Resources

Secondly, the movement pattern along the chain, which provide the links between the fixed elements. Since most supply chains have evolved over time and have not been planed as single systems, they are often complex and inefficient. Mapping the supply chain is according to Taylor a good way of untangling these complexities and pinpoint where the problem lies.

The information flow

The second important flow is related to information management. Taylor have identified four key issues that needs to be addressed:

- Order processing information. This deals with the systems that identify and process the orders throughout the supply chain. The information flow moves in the opposite direction to and initiates the physical flow of goods. Then a second flow of information accompanies the movement of the physical product through the system.

- Demand forecasting information. The accuracy of this information is very important since it determines plant capacity, inventory, transportation and various financial arrangements.
- Management information. To be able to monitor the efficiency of logistics operations management must have reliable information. Information can include issues like warehouse productivity as vehicle utilization.
- Computer systems. The last aspect of information management addresses the importance of linking different systems together.

Organization and managerial structures

The third important factor that should be addressed is the organizational structures that control the supply chain. Taylor means that the essence of logistics is to develop an integrated approach to the management of the whole supply chain. Therefore it is important to understand the structures, functions and attitudes that control the system. The analysis of the

management structures should be conducted on two levels: the individual firm, and the supply chain as a whole, including other companies. Most traditional organizations are organized in functional structures where materials and information flow horizontally across these functions. To understand the flows is important to determine the different groups objectives and their relation to the logistic activities.

Furthermore, getting the backing from senior management is crucial to achieve successful changes in the company. These issues become even more important to bear in mind in international organizations, where national organizations can have different or conflicting goals. Considering that the supply chain can consist of various companies these issues becomes even more complex.

Supply chain performance

To understand how a company is performing it is necessary to compare it with other organizations. Taylor suggests that this should be done at three levels. The first is the overall performance of the supply chain. A company must evaluate and quantify their existing performance. Two things are important to focus on: the customer service and logistic costs. The second part is to compare the company's relative performance with other companies. Activities to examine are customer service, logistics costs, systems and technology and inventory levels. The third part is to evaluate the performance of individual logistical functions. Alongside with analyzing the different flows, a company might need to look deeper into certain functions.

The Business context

For a clear understanding of the role logistics play in a company, the corporate business strategy and the marketing strategy must be assessed. What needs to be established is how these strategies affect the logistic activities. An assessment of the external business environment is the last

factor to consider. The company cannot control the environment, but it can adapt and change as the environment alters.

Step 2. Identification of main problems and issues

This step consists of three parts. The first is to identify all the problems. Taylor suggests that you should make up a list of all the problems. This is the most crucial part since discovering the real problems can be more difficult than finding the solution. The second part is to categorize the problems. Is it a problem that needs to be solved or is it an opportunity that exist? Is it a strategic or operational issue? What is important at this stage is to differentiate between symptoms and causes. The analysis must find the underlying reason for a problem. The last part deals with prioritizing which problems and issues that needs to be addressed.

Step 3. Generation and evaluation of alternative solutions

As the main problem has been discovered a creative process must follow when ideas and solutions can be generated. This brainstorming might lead to options that should be evaluated.

Step 4. Recommended solution and justification

The fourth step is to take a decision on the evaluation of the different alternatives generated during step three. Taylor suggests that a full description of the chosen solution should be given accompanied with a cost/benefit analysis.

Step 5. Implementation

The last step considers the practical issues of implementation of a recommended solution. A company deciding to move ahead with a project must be prepared to devote resources and time. To know if the project is successful or not, the measurement of benefits and costs should also be decided.

Appendix 5

The following assumptions is the foundation for our calculation:

- The interest rate is 7%.
- All calculations are made in Australian dollar (AUD).
- Prices are taken from the 'Head office management price list' in Australia.
- The Cost reduction in holding stock is the reduction in stock due to limitation of duplication and the savings in alternative costs when the stock turn twice a year instead of 1,5 times a year.
- Changes in transportation costs are the costs that are saved or lost due to extra transportation to Australia.
- Lost sales are an estimation of how much sales that would be lost due to lack of machines to show customers. A low estimitation would be that due to difficulties in showing customers machines sales would decrease with 10%. However, the Singapore SC will probably capture some deals, lowering the amount of lost sales. But since the Australian market is three times as big, we believe that they will loose far more than they will sell in SEA markets.
- To calculate how large the loss would be in dollars speaking we have used the consolidated gross margin within Volvo CE. Since we do not have the actual margin, we have used a rough estimate that the PC in Eskilstuna add a 15% margin on Wheel loaders and the PC in Braås add a 20% margin on prices set for the SC Australia. These estimation have been recommended by a controller at the HQ. To

this estimated margin the actual margin for the machines in Australia has been added.

- Rebuilding costs are the extra costs that are induced when machines are to be adjusted to suit a particular market. We have estimated that the cost would be around AUD 1,000 per machine. Since most of the products ordered to the Singapore warehouse should be for the Australian market, there should not be so much rebuilding.

- Clearance at port and in-land transportation is expected to be the same as in Singapore as in Australia. However, the duty is deducted from machines brought in to Singapore.

- Extra costs in Singapore are those costs associated with extra in-land transportation and extra activities at port in Singapore. These are expected to be the same as when bringing in a machine to Singapore.

- The number of machines in this calculation is 20 units. Since the stock turns twice a year this will mean that 40 machines are brought into the Singapore warehouse and out again. Since the SC in Australia sell almost 75% of the total sales in the two regions we calculate that they will draw 30 (20*2*0,75) machines the first year from the central warehouse to Australia.

- From what is held in Australia warehouse today, one Wheel Loader the L330C, one Excavator the EC460/SE450, and one Motor Grader the 780 AVHP have been excluded, since they pose rather difficult transportation that increase costs significantly. Since they also are very low volume products the inventory turn is less often and transporting them between continents would destroy the whole gross margin. We have also excluded the Wheel loaders L90C and L120C that are held in the Singapore warehouse today, since dealers in Australia hold them in stock.

- Since most of the machines are on consignment at dealers site, there are not really any costs for running the warehouse in Minto related to holding machines. The costs for the warehouse today, are mostly for supplying and storing spare parts. Machines are only using the ground in Minto. Therefore, we will not add any costs for rent etc. The same goes for the Singapore warehouse, since they have a very low inventory.

	Australia					
Model	Cost to bring in	Gross profit per machine at SC	Inventory Cost per machine	Total cost	Inventory Transportation cost	Total transp. Cost
L150C	205284	15962	9570	28711	11250	33750
L180C	255070	27359	11891	35674	13200	39600
L220D	330718	38721	15418	46254	15000	45000
A30	284581	6327	13267	39801	15000	45000
A35	372974	12000	17388	52164	18300	54900
A40	440281	24000	20526	41052	19000	38000
Total		**124369**	**88061**	**243657**	**91750**	**256250**

Australia	Expected sales AUS	Total Gross profit SC	PC Gross profit per machine	Total Gross profit PC	**Total Gross profit**
Model	1999	1999	1999	1999	1999
L150C	11	175582	26776	294538	470120
L180C	5	136795	33270	166350	303145
L220D	6	232326	43137	258823	491149
A30	10	63270	47430	474302	537572
A35	5	60000	62162	310812	370812
A40	2	48000	73380	146760	194760
Total	**39**	**715973**	**286156**	**1651584**	**2367557**

Gross profit at PC is calculated for Wheel loaders i.e. L150C etc. at 15%, Articualted haulers i.e. A30. etc at 20%.

Alltogheter the total gross profit for these machines in Australia are AUD 2,367,557. Lost sales are 10% of this amount, AUD 236,755

The total cost of holding inventory in Australia is AUD 243,657.

	Singapore				
Model	Cost to bring in	Gross profit per machine	Inventory cost per machine	Total Inventory cost	Transport	Clearence
L150C	191968		8950	8950	3440	5034
L180C	239057		11145	11145	4040	6584
A35	347519		16201	113409	4920	6758
Total			**36296**	**133504**	**12400**	**18376**

Total inventory cost for the Singapore warehouse is AUD 133,504

Total inventory cost for both warehouses are A$243,657+A$133,504 =A$344,758

Singapore CW	Cost to bring in FOB(AUS)	Duty+Clearance AUS	Costs to bring in Singapore	No of machines
L150C	183494	10540	191969	3
L180C	228433	13437	239057	3
L220D	297806	17912	311384	2
A30	254982	14599	265852	3
A35	335841	18833	349519	7
A40	398924	22357	414993	2
Total				**20**

Singapore CW	Transportation to Sing	Clearance	Inventory cost	Total Inventory cost	M3	Transport to AUS
L150C	3440	5035	6719	20157	86	6622
L180C	4040	6584	8367	25101	101	7777
L220D	4600	8978	10898	21797	115	8855
A30	3920	6950	9305	27914	98	7546
A35	4920	8758	12233	85632	123	9471
A40	5680	10389	14525	29050	142	10934
Total				**209651**		

The total inventory cost for a central warehouse in Singapore is
= AUD 209,651

Singapore CW	Cost machine AUS	Transport cost change	Extra handling cost

L150C	211131	1188	5035
L180C	262271	1383	6584
L220D	340151	1545	8978
A30	289997	3534	6950
A35	379823	3909	8758
A40	450284	2386	10389
Total		**13945**	

Singapore CW	Assumption of no machines	Total clearance cost	Total transport change
L150C	5	25175	5940
L180C	5	32920	6915
L220D	3	26934	4635
A30	5	34750	17670
A35	9	78822	35181
A40	3	31167	7158
Total	**30**	**229768**	**77499**

Savings in transportation costs are AUD 77,499

The extra costs in handling machines in getting machines out of Singapore to Australia is AUD 229,768

Route:	Transport cost M3
Got-Sing	40
Got-Sydney	130
Sydney-Sing	77
Sing-Sydney	77

The rebuilding of the machines are AUD 1,000 per each and since 10 machines are that are sold to SEA customers built for Australia standards they have to be modified. The cost of rebuilding is then AUD 10,000

Concluding calculation

Cost reduction in stockhold	167510
Change transport cost	77499
Lost sales	-236756
Rebuilding	-10000
Extra costs Singapore	-229768
Total	**-231515**
Without lost sales Total	**5241**

Since the difference is only AUD 5,241 the break even point for a warehouse in Singapore to be profitable is when less than one machine deal is lost in Australia, when savings in holdig costs, extra handling costs and transportation is considered.

Appendix 6

The following assumptions is the foundation for our calculation:

- The interest rate is 7%.
- All calculations are made in Australian dollar (AUD).
- Prices are taken from the 'Head office management price list' in Australia.
- The Cost reduction in holding stock is the reduction in stock due to the savings in alternative costs when the stock turn twice a year instead of 1,5 times a year.
- The transportation cost is AUD 70 per cubic meter with Ro/Ro vessel. Due to the size of these machines, we used boat and not road as transportation alternative.
- Lost sales are an estimation of how much sales that would be lost due to lack of machines to show customers. We have used the lost gross profit at SC in Australia as measurement of this loss. We believe that they might loose 5% of the yearly sales, because they are not able to show machines fast enough.
- To calculate how large the loss would be in dollars speaking we have used the consolidated gross margin within Volvo CE. Since we do not have the actual margin, we have used a rough estimate that the PC in Eskilstuna add a 15% margin on Wheel loaders and the PC in Braås add a 20% margin on prices set for the SC Australia. These estimation have been recommended by a controller at the HQ. To this estimated margin the actual margin for the machines in Australia has been added.

- Extra handling at the ports would probably be around AUD 10 per cubic meter.

	Australia		
Model	Cost to bring in	Gross profit per machine	Inventory Cost per machine
L150C	205284	15962	7185
L180C	255070	27359	8927
L220D	330718	38721	11575
A30	284581	6327	9960
A35	372974	12000	13054
A40	440281	24000	15410
Total		**124369**	**66112**

Model	Transport	Extra handling	M3	Inventory Cost per machine1,5 turn a year
L150C	6020	860	86	9484
L180C	7070	1010	101	11784
L220D	8050	1150	115	15279
A30	6860	980	98	13148
A35	8610	1230	123	17231
A40	9940	1420	142	20341
Total	**46550**	**6650**		**87268**

Reduction in inventory cost is derived by subtracting inventory turn of 1,5 (87,268)with inventory turn of 2 (66,112)= AUD 21,156

Extra transportation cost is calculated by multiplying total M3 with cost per M3 (AUD 70) with vessels= AUD 46,550

Extra handling cost is calculated by multiplying total M3 with AUD 10 = AUD 6,650

	Expected sales AUS	Total Gross profit at SC	PC Gross profit per machine
Model	1999	1999	1999
L150C	11	175582	26776
L180C	5	136795	33270
L220D	6	232326	43137
A30	10	63270	47430
A35	5	60000	62162
A40	2	48000	73380
Total	**39**	**715973**	**286156**

	Total Gross profit PC	**Total Gross profit**
Model	1999	1999
L150C	294538	470120
L180C	166350	303145
L220D	258823	491149
A30	474302	537572
A35	310812	370812
A40	146760	194760
Total	**1651584**	**2367557**

Lost sales is 5% of 2,367, 557= AUD 118,378

Concluding calculation	
Cost reduction in stockhold	21,156
Total transportation cost	-46,550
Lost sales	-118,378
Extra handling costs	-6,650
Total	**-150,422**
Without lost sales Total	**-32,044**

Appendix 7

Questionnaires (in order of when the interviews were conducted)

The Questionnaire for the Brussels meeting with Volvo CE HQ

INTRODUCTORY QUESTIONS

- How is Volvo CE doing right now in SEA?
- What are the big opportunities in the SEA?
- What are Volvo CE's major problems in SEA?
- What is the strategy for Volvo CE in SEA in a short term and long term perspective?
- How does the competitive situation look like in SEA?
- What does Volvo CE do better than the competitors?
- How does the market situation look like?
- Which products move fastest in SEA?

THE DISTRIBUTION

- How does the supply chain from production to end-customers look like?
- Where are the warehouses in SEA located?
- What kinds of products are stored in which locations?
- What are the problems with the distribution of products to SEA?
- Who transport the products and spare parts in SEA?

- Where are the production facilities located in the world?
- Which products are produced where?
- Does Volvo CE have plans of relocating production?
- To which extent is modular production used in Volvo CE?
- Is there any standardisation of components?
- Does Volvo CE produce any customised products?

DISTRIBUTORS AND DEALERS

- How does the distribution network look like in SEA?
- What is the Volvo CE's strategy for dealers in the region?
- How are Volvo CE helping and promoting the dealers in the region?
- Why did Volvo CE rationalise their distributors?
- What is the level of IT used in relationship with dealers? For example, communication, invoicing, current stock levels etc.
- To which extent is the "Circle of excellence programme" integrated with dealers in SEA?
- What are the criteria's for becoming a dealer in SEA?
- How competent are the dealers? Are they missing anything?

Questionnaire for interview with Arne Jensen

- Vilka faktorer bör man ta hänsyn till när man konstruerar en Supply chain i strategisk mening för ett företag i ovan nämnda situation?
- På vilket sätt bör man resonera i frågan om ett Centralt varulager är mer lönsamt än lokala varulager?
- Finns det teorier som tar upp sådana här frågor för industriprodukter?
- Vilken är den korrekta teoretiska benämningen på vårt problem? OTP, OTD, ERP, Supply chain management? Vad består skillnaderna i?
- Hur skiljer sig ett Distribution Center från Varulager?
- I vilken utsträckning kan IT användas i detta fall för att sänka ledtider, för att bestämma om hur Varulagersfrågan ska lösas?
- Finns det Benchmarkingstudier på lyckosamma logistiklösningar av liknande företag?

Questionnaire for the PC in Eskilstuna

"Introduktionsfrågor"

- Hur ser flödeskedjan ut av information / produkter inom er enhet? Vi önskar träffa en ur varje sekvens.

- Har ni information på hur lång tid respektive sekvens i kedjan tar?

“Ordermottagaren”

- Är du första instansen för ordermottagande? Får någon annan orderbeställningen samtidigt?
- Hur kommer ordern dig tillhanda? Brev, fax, telefon eller mail?
- Vad gör du med ordern?
- På vilket sätt går orderhanteringen vidare från dig?
- Är det ett bra hanteringssätt? Skulle det kunna hanteras mer effektivt?
- Vad är ditt ansvar / Hur mäts effektiviteten av ditt arbete?

”Produktionsplaneraren”

- Vilka faktorer/information påverkar produktionsplaneringen? Från vilka källor kommer den informationen?
- Vad är ditt huvudsakliga/operativa ansvar?
- Är principen ”Sell one, make one” applicerbar för Asiatiska marknaden också? Lokala krav på hopsättning, olika regelverk etc.
- Hur är din syn på varulagersoptimering i Sydostasien givet rådande produktionsplanering?
- Hur stor kapacitet har fabriken?
- Hur många lokala varianter på hjullastaren tillverkas härifrån? Hur mycket av produkten produceras/sätts ihop här givet transportkostnader/lokala krav.
- Hur är fördelningen leverans direkt till kund mot leverans till Spekulationsvarulager? Hur är trenden? Hur påverkar det behovet av Varulager?

”Transport-kordineraren”

- Hur kommer informationen fram att varor är redo för transport? Hur länge står produkter och väntar på att bli ivägskickade?

- Har ni möjlighet att redan på orderstadiet ge kunderna/återförsäljarna indikation på hur lång tid det tar innan produkten är hos kund?
- Hur sker kontakterna med transportbolaget? På vilket sätt samarbetar ni med dem (Volvo Transport?)?
- Hur går det tillväga när maskiner skickas från Eskilstuna till kund?

”Fabriksansvarig”

- Hur är Volvos logistiska strategi upplagd?
- Vad har du för ansvar? På vilka premisser utvärderas fabriken?
- Vilken är strategin – skalfördelar eller snabb leverans till kund?
- Vilken typ av import restriktioner möter ni i Sydostasien?
- Vad anser du om strategin ”sell one, make one”?

Allmänna frågor

- Finns det några flaskhalsar
- Vad är största problemet i verksamheten
- Vad gör Volvo CE bättre än konkurrenterna
- Vad är den logistiska strategin/filosofin? – Vad är det som gjort att ni anser att detta är det bästa sättet att jobba på?
- Vilket synsätt är det vanligaste – ”vi måste sänka kostnaderna” eller ”vi måste fokusera på vad våra kunder kräver”?

Questionnaire for Australia

Top management, Tomas Edling Manager Australia

Strategic issues

- What is the strategy for Volvo CE in Australia?
- What is the dominating philosophy; cutting costs or maximize customer service?
- What are your biggest obstacles of growing in Australia?
- What needs to be adjusted?

Warehouse issues

- What were the main reasons for locating a warehouse to Australia?
- What do you think will happen if the warehouse in Sydney is closed down?
- What kind of measures had to be taken if it were?
- Have you done any cost/benefit analysis of having a local warehouse?
- How many more machines are sold by having a local warehouse?

Tariff and non-tariff barriers

- What kind of barriers to trade is there? Duties, administrative, quotas etc.
- To what extent are machines adapted to the Australian market?
- Is there any local assembly?

Coordination issues

- Do all orders go through Singapore?
- Do you source all products from Sweden or do you also use the warehouse in Singapore?

Finance, Paul Torrington CFO

Strategic issues

- What is the dominating philosophy; cutting costs or maximize customer service?

How are forecasts made?

- Are product lead times a strategic issue for Volvo CE, given the fact that competitors have local assembly?
- What is the degree of IT used in relationships with dealers? For example invoicing, communication, orders, current stock levels etc?

Warehouse issues

- In the local warehouse, which and how many products are in stock?
- How long time do the products spend in stock?
- What is the total cost of running the warehouse?
- What were the main reasons for locating a warehouse to Australia?

Financial targets/measurements

- What financial targets has Volvo CE put up for the Australian market?
- Maintaining/improving profit margins are apparently important, what are you focusing on to achieve it?
- Do you track the profitability of different products (ABC costing)?
- Do you track profitability of different customers?
- How much does it cost to ship a machine to Australia?
- How are Volvo CE Australia's earnings compared to competitors?
    - Revenues
    - Profitability

Marketing and Sales

Strategic issues

- What is the ratio between deliveries directly from factory to end customer and from warehouse to customer?
- What is Volvo CE's strategy for Australia?
- What is the dominating philosophy; cutting costs or maximize customer service?
- What is the degree of IT used in relationships with dealers? For example invoicing, communication, orders, current stock levels etc?
- Are there any requirements for local adaptations?

Customer focus

- Which customer segments do you serve in Australia?

- What are the most important criteria's for a customer buying a Volvo machine?
- How do you go about when an order is placed for a new machine?
- What kind of finance alternatives is offered to customers?

Delivery issues

- Do delivery time matter for customers?
- How long time are customers prepared to wait for a machine?
- How many machines do you miss to sell because of long delivery cycles?
- How much more sales would you achieve with 2 respectively 4 weeks of delivery?
- When a machine is sold does the customer now exactly when it is going to be delivered?
- What do you think of the supply chain, any room for improvement?
- The long lead-time, has it hindered you from going into certain customer segments?

The Dealers

- How do you place an order?
- How do you get information if the machines are in stock or not? Phone, website, fax etc
- What are the most important criteria for a Volvo customer buying a new machine?
- What does customer think of Volvo's current delivery times? Are they reliable?
- What is most important fast deliveries or a low price?
- Who are your main customers? In which industries are they?
- Does it happen that customers order directly from Volvo CE?
- What is the degree of IT used in relationships with Volvo? For example communication, orders, current stock levels etc?
- What do you think Volvo CE should improve?

- Could you be able to put together a machine? For example would it be feasible with a central warehouse will all components in one country, having you as a dealer ordering all parts and thereafter assemble the whole machine. Beroende på vad vi får veta i Eskilstuna, får vi se om vi ställer denna fråga!

Questionnaire for Singapore

Top management

Strategic issues

- What is the strategy for Volvo CE in Asia?
- What is the dominating philosophy; cutting costs or maximize customer service?
- What are your biggest obstacles of growing in Asia except the economic crisis?
- What needs to be adjusted?
- What will happen when Korea becomes a hub for the whole region?
- Is the head office going to be moved then?

Warehouse issues

- What were the main reasons for locating a warehouse to Singapore?
- What do you think will happen if the warehouse in Singapore is closed down?
- How important is it to have to serve other countries?
- What kind of measures had to be taken if it were?
- Have you done any cost/benefit analysis of having a local warehouse?
- How many more machines are sold by having a local warehouse?

Tariff and non-tariff barriers

- What kind of barriers to trade is there? Duties, administrative, quotas etc.
- To which extent are machines adjusted to different rules and regulations in the various countries you are active in?
- In which countries are local assembly required?

Coordination issues

- Do you source all products from Sweden or do you also use the warehouse in Australia?
- How many machines are sourced from Korea?
- Do you coordinate any activities with Australia?

Finance, Ck Chan

Strategic issues

- What is the dominating philosophy; cutting costs or maximize customer service?

How are forecasts made?

- Are product lead times a strategic issue for Volvo CE, given the fact that competitors have local assembly?
- What is the degree of IT used in relationships with dealers? For example invoicing, communication, orders, current stock levels etc?

Warehouse issues

- In the local warehouse, which and how many products are in stock?
- How long time do the products spend in stock?
- What is the total cost of running the warehouse?
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Financial targets/measurements

- What financial targets has Volvo CE put up for the Asian market?
- Maintaining/improving profit margins are apparently important, what are you focusing on to achieve it?

- Do you track the profitability of different products (ABC costing)?
- Do you track profitability of different customers?
- How much does it cost to ship a machine to Asia?
- How are Volvo CE Asia's earnings compared to competitors?
    - Revenues
    - Profitability

Marketing and Sales, Nick Mules

Strategic issues

- What is the ratio between deliveries directly from factory to end customer and from warehouse to customer?
- What is Volvo CE's strategy for Australia?
- What is the dominating philosophy; cutting costs or maximize customer service?
- What is the degree of IT used in relationships with dealers? For example invoicing, communication, orders, current stock levels etc?
- Are there any requirements for local adaptations?

Customer focus

- Which customer segments do you serve in Australia?
- What are the most important criteria's for a customer buying a Volvo machine?
- How do you go about when an order is placed for a new machine?
- What kind of finance alternatives is offered to customers?

Delivery issues

- Do delivery time matter for customers?
- How long time are customers prepared to wait for a machine?
- How many machines do you miss to sell because of long delivery cycles?

- How much more sales would you achieve with 2 respectively 4 weeks of delivery?
- When a machine is sold does the customer now exactly when it is going to be delivered?
- What do you think of the supply chain, any room for improvement?
- The long lead-time, has it hindered you from going into certain customer segments?

Issues discussed with Singapore office

- Information regarding transportation cost to all countries in the region.
- Complete distances between various dealers and the cost of shipment.
- Information about alternative location of a warehouse.
- Rules and regulations that is important to keep in mind.