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Performance of Electronic Data Interchange in the Process of Lead Time Reduction

- A Process Management Focus -

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Abstract

The theme of our study is the concept of electronic network. We have studied electronic network in relation to process management. We define process management the process of creating associational relations and sustaining corporate competitive advantage through reduction of lead-time. This definition involves (1) understanding and describing the context in which managers work (2) developing some proper and consistent communication tool and (3) implementing it to create relational alignment and sustain competitive advantage. We have developed our own framework for this study relevant to continue our study of process management regards to the context of Volvo Car Corporation.

Our empirical materials are grounded on process management in Volvo Car Corporation and explore how managers in Volvo Car Corporation relate their company to their suppliers. To be clear on this, we looked at electronic network and the way this communicative mechanism can serve improvement of process management in Volvo Car Corporation. In relation to process management, we addressed a couple of questions. The overall conclusion drawn from our study is that, Volvo Car Corporation can improve their traditional communication system based on EDI further by using Internet. By assigning EDI via Internet, there are good possibilities for improvements, in particular, to reduce the lead-time. Further we explored that electronic network can be used in an effective way to improve associational relationship with suppliers. Finally, our study led to presentation of some key-concepts that are relevant for description of process management in Volvo Car Corporation. These concepts; lead-time, risk, less inventory, information technology and use of EDI, are drawn from the context of interviews that we made with suppliers and exchange of view with managers in Volvo Car Corporation. Our study ended up with a presentation of a model that we hope has implication for Volvo Car Corporation.

Key words: EDI, EDI via Internet, Lead-time, Electronic Network, Supplier, Information Technology, Process Management.

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Gothenburg, January 9th, 2001-01-09

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In this chapter, we present a background to our study. We discuss the concept of Just in Time (JIT), and also what role electronic network plays in communication. The main part of the chapter is devoted to our problem discussion. In the final section we will talk about the objective of the study.

1 Introduction

Today, electronic commerce is expanding and electronic network exchange plays a key role in business communication between firms, and their external environments, e.g. suppliers. Electronic data interchange (EDI) is a communication system that exchanges common documents electronically such as purchasing orders, invoices and funds transferees from businesses to businesses. Volvo Car Corporation uses this system. Throughout our study we will refer to Volvo Car Corporation as Volvo.

Specifically, this study will examine the key role of electronic networking; by this we mean the contact between suppliers and a company. First, we start to present a background to network and the rise of electronic network exchange. Second, we try to point out the important issues and problems that we believe are closely related to the change of communication system - from a more traditional method to Internet. We continue to discuss that, as a new industrial engineering, employment of Internet seems to be essential for development of a new relationships between the firm and its suppliers. It is, in regard to the issues and problems of Internet and process management, relevant for building up the electronic network that this study addresses its basic questions.

1.1 Background

A part of the development of process management has its background in another process. As an example, look at the car manufacturing industry. In 1999, major car manufacturers such as Ford, General Motors (GM) and Daimler-Chrysler started to build up the so-called business-to-business procurement system. They link the suppliers to their own procurement system. With the intention to achieve a cost reduction, Ford, GM and Daimler-Chrysler

combined their joint efforts in the service of a common plan. On the 25th of February 2000 they announced their plan; by merging their procurement systems to build an industry wide business-to-business procurement system that is based on Internet. In practice they integrate supplier exchange through a single global portal, forming what may be the world's largest virtual marketplace (See booklet of Industrial Distribution; Ford, GM and Daimler-Chrysler join forces, April 2000 v.89 i4 p. 21). It has been decided that the Internet-based trade exchange will be named Covisint. The name was chosen to reflect communication, vision and integration.

Covisint provides a portal for suppliers to improve speed of transactions and communications with original equipment manufacturers, as well as with their own supply base. The exchange consist of three basic elements; firstly, a set of community capabilities that let suppliers and manufacturers collaborate, secondly, a transaction system that enables procurements and auctions, and finally a set of trading applications that let suppliers and customer trade data about demand for parts and materials, and also exchange order information.

1.2 Just-In-Time (JIT)

Electronic networks can serve Just-In-Time (JIT) processes in manufacturing companies. In the past years European firms have given a lot of attention to improvement of JIT by means of networking and business-to-business e-commerce procurement. JIT was introduced in Japan, and it soon became an interesting issue for the management of resources and fields of new competences. Since the 1950s, Japan has continuously increased its share of world trade when using the JIT manufacturing system, and was in the 1990s the dominant manufacturing economy (Waters, 1996).

At the time being, the JIT system is improved and as a system it is capable organising all operations of materials so that they occur just at the time they are needed (Minahan, 1998). If materials arrive just as they are needed, stocks of work in progress can be eliminated. The JIT system tries to eliminate all waste within an organisation. Its aim is to meet production targets using the

minimum amount of materials, with the minimum amount of equipment, and also the smallest number of operators, etc. By doing this, organisations make sure that all operations are done just at the time that they are needed. (Cheng and Podolsky, 1993).

JIT as a system can only be applied in certain types of organisations, since it needs a stable environment where production of an item remains at a fixed level for some time. This stable environment allows costs to be reduced by using specialised automation. Furthermore, JIT works best with high volume and mass production operations so that the fixed costs can be recovered with high production volume. The most successful users of JIT are car assembly plants that can make large numbers of identical products in a continuous process. Lead-times and set-up times must be short, this means that the firm is working closely with its suppliers. Reduction of lead-time is important for the Swedish industry in order to improve their communication network capacity.

Volvo is planning to apply EDI via Internet, a network exchange system, as a method to communicate with their supplier. As a part of the network, Volvo is considering implementing a new process management with advanced network technologies. One of the objectives that this study intends to follow is the notion of achieving lead-time reduction by improving the suppliers-firm relationship. Reducing the time of supply is a viable economic benefit, which is equally crucial for the management of JIT (O´Grady, 1990). Communication is important for both parties that are using the JIT system, since the system cannot work satisfactorily if there is a communication problem between the parties.

1.3 The role of EDI in communication

The idea of electronic networks starts with Electronic Data Interchange (EDI).

> "EDI is the electronic transfer from computer to computer of commercial or administrative transactions using an agreed standard to structure the transaction or message of data and between independent computerised systems." (Hörluck, 1993 p.12)

What is important to remember in relation to EDI is that EDI is a transfer between computers, i.e. there is no human intervention and data are defined and structured according to an agreed standard. EDI is more than the exchange of data, it includes a computer-based system that allows companies to order, invoice, and bill their products and services electronically. The purpose of using EDI is to use communication between programs and also to shorten the lead-time between suppliers. The intention behind the sending of an application's message is to get the receiver's application to perform a specific function. Volvo is one company that uses this system for their transactions.

Automatic electronic transfers between firms and suppliers' computers replaced common transaction, such as invoicing, shipping and billing, which traditionally have entailed human interaction and the transfer and processing of paper documents. EDI allowed firms to operate on the basis of information exchange. Each exchange has a purpose, which is to let the receiving organisation act upon the message received. In any communication it is a problem to assure that the receiver understands the sender's intentions and that the receiver's actions are conditioned by these intentions. Since the receiver of an EDI message is a program, these intentions must be anticipated to be programmed.

1.4 A change of focus from EDI to Internet

Car manufacturers are driving their development of web-based supply chain management into the fast lane, by moving their EDI base on procurement operations to Internet. Internet will beside taking advantage of the inherent cost savings with its transactions, initially promote procurement efficiencies and allow purchasing professionals to focus on product quality, supplier competitiveness, performance and time to market. With better, faster, more efficient supply chains and efficient acquisition of component parts, commodities, supplies and services can provide better products and services for the customers (Lasecke-Jacobs, 1999).

1.5 Problem discussion

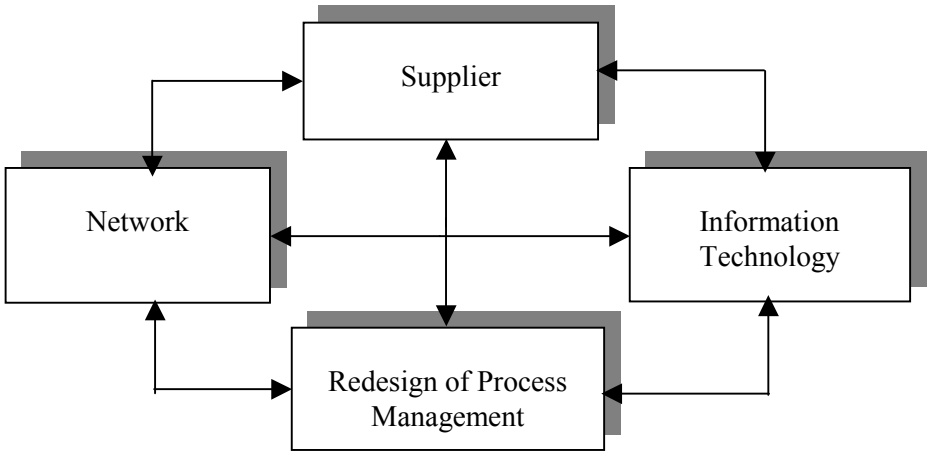
Firms communicate with their customers and their suppliers, as discussed in the earlier sections, more often than before, through a new communication technique. Implementation of the new technique demands a new process management. By process management we mean a set of communicative activities aimed at achieving a defined business outcome. To shorten the lead-time can be considered as the outcome of the process management. By communicative activity we mean the use of networking as creating relational contact with suppliers. In fact, the maintenance of a sustainable product manufacturing and product innovation needs creation of a good relationship with suppliers (Brandes, 1971). The traditional management view of Research and Development (R&D) and manufacturing is changing, and the importance of suppliers' relationship motivates re-designation of the process management, in terms of advanced communication.

Considering a process management in which electronic networking for collaboration with suppliers is appreciated, product development and product manufacturing have become less dependent on R&D program. Electronic networking management can develop new processes in order to bring in the external competence and component knowledge within the firm, to support new techniques, product innovation and product manufacturing.

Our primary study indicates that, in Volvo the system of EDI is in operation and plays a key role in process management for establishing supplier relationships. In particular, EDI facilitates a network communication with a number of suppliers that Volvo regards as being strategically important. In spite of this, EDI has a number of weaknesses. First of all, it is an expensive system to buy and implement. Second, the firms must have staffs that have expertise about the system. Third, one possibility could be that suppliers who do not have the expertise cannot use the system effectively. Forth, EDI system must continuously be fitted to internal environment of the company, and this costs a lot of money. Finally, EDI is a highly standardised tool, which can be difficult to use for non-standardised information interchange.

In order to eliminate these weaknesses, Volvo has intentions to use the capacity of the 'network exchange' to improve its communication network, with their suppliers further. A move from the tradition of EDI to Internet means to deal with several problems. Above all, reaction from suppliers has to be mapped. For the process management at Volvo, it is interesting to see how suppliers may react, and how they may use the system. What are the suppliers going to think about the new system? Are the management processes in Volvo going to be affected? What is the future management process going to look like? If the communication system is going to be changed from the traditional EDI to EDI via Internet, these questions are all important. These issues can be illustrated within the scope of the concepts presented below.

Figure 1.1, The basic concepts, in which process management can be identified.



These four concepts are going to be further described below. This study focuses on the issues and problems that process management faces if the lead-time is going to be reduced.

1.5.1 Network

The role of networks is more and more important in today's business environment. It is a key source of competitive advantage, where competition between firms is replaced by competition between networks (Bozdogan, 1998). But, above all, networking is more relevant for creation of associational relation with the suppliers. It is argued that, many innovations in product

development are achieved through early supplier's integration (Cooke and Morgan, 1998). Suppliers are an important source of innovation.

Communication systems that can improve, in the context of process management, may rely on specialised actors to transfer information from the environment, or may involve less structured patterns. The problem of designing communication cannot be disentangled from the distribution of management professional expertise in the organisation (Wesley, 1990).

Companies want to leverage the Intranet and the Internet to make existing business processes more efficient and more profitable. At the heart of the network communication model, there are commerce solutions that facilitate the process of purchasing low-cost, high volume goods for maintenance, repair and operations of a business. For example, the labour and paper-intensive operations may be converted into self-service applications where purchase approvals and business policies are enforced through automated business rules. Corporate procurement commerce solutions allow transactions to be made with partnering businesses, suppliers and distributors, regardless of data and format. This new system can lead to a reduction in lead-time.

Through electronic communication, small companies can get the same material and parts as large companies. Small companies can benefit from the same services as large corporations. According to Dicken (1992) information technology is transforming both the technologies of transport and communications, but also technologies of products and processes. As computers get networked, they become a tool not only for individual productivity, but also for co-operation within and between suppliers.

1.5.2 Suppliers

Companies realise more and more that their capacity for innovation, learning, and quality depends on their ability to secure the active co-operations, with their suppliers. A large barrier of the supply-chain integration is the divergence between rhetoric and reality. To be effective, supply-chain integration must

have a trust towards its co-workers and companies, since the benefits flow in both directions. Although, a trust based partnerships can be difficult to construct, not least because trust has to be earned rather than decreed, they constitute intangible assets that more innovative firms recognise as important as tangible assets.

The suppliers at Volvo are all involved in the supply-chain integration, and they are divided into different Tiers. A Tier is a group of suppliers that deliver parts to the Tier above or sometimes directly to Volvo. Network communication between suppliers is important, when exchanging information among individuals throughout an organisation (Cooke and Morgan, 1998).

1.5.3 Information Technology

The term information technology is used to refer to products and services that are used to build information systems to support a company's business. When trading on the Internet, a secure way to exchange business information between the trading partners is important. Trading partners with high levels of automation and reliability often exchange information using EDI, on leased lines or value added networks (VANs). The commerce interchange pipeline (CIP), a flexible workflow system, which is designed to simplify the integration of business communication among Internet-based partners, can be used to provide integration of EDI for handling business information via Internet.

The rapid development in the field of information technology (IT) also creates new possibilities for increased efficiency and effectiveness in material flows. The rapid growth of new management philosophies, for example process management, in recent years may be explained by the rapidly changing environment and efforts of the creative professional change agents.

1.5.4 Process management

Process management is, in the sense that we understood, the process of creating associational relationships and sustaining corporate competitive advantage through reduction of lead-time. It involves understanding and a descriptive context in which managers' work, developing some proper and consistent communication tool and also implementing it to create relational alignment and sustain competitive advantage.

In recent years, as a reaction to the changing business environment, a new management style has emerged. This means that the old principle for action are now of less value, and there is a need for change in management and control, replacing the old style of the past. With this in mind, companies must adopt new methods of management characterised by a strong focus on time, customers, value, quality and networking.

Process management is a concept relevant for focusing on the importance of time and networking. The importance of time in industry has been well known for a long time. In the last decade, the focus on time has been much stricter than previously. Competition between companies, due to e.g. globalisation, forces companies to reduce lead-time in order to be competitive.

The main questions that this study emphasises, is the identification of the major factors that electronic network exchange and creation of networking can have in re-designation of process management at Volvo, in order to reduce lead-time. We are focusing on reducing the lead-time with this we mean only the speed of information and not other concepts that are related to lead-time reduction e.g. administrative-, transaction costs. In regards to this focus, we are going to develop three questions

- What is the role of electronic network exchange when structuring a new process management between Volvo and its suppliers?

- How may an approach by EDI and EDI via Internet, be interpreted by the different Tiers?

- In what way may electronic network exchange support the design of new process management?

1.6 Purpose

Our main purpose with this study is to, by means of information drawn from the sources of suppliers, hopefully improve the process management at Volvo.

1.7 Delimitations

In our study we are focusing on reducing the lead-time in relation to process management. To achieve reduced lead time is important to Volvo, and this is why we focus mostly on the speed of information and not on other relevant concepts connected with lead-time, as reduced administration costs or transaction costs etc.

1.8 Conceptual Definitions

Concept of electronic network exchange: We define electronic network exchange as electronic capacity to improve the communication between parties.

Concept of electronic networking: We define electronic networking by the contact between suppliers and a company.

Concept of JIT: JIT manufacturing is a Japanese management philosophy applied in manufacturing, which involves having the right items of the right quality and quantity in the right place and at the right time.

Concept of lead-time: Lead-time normally includes all activities from start to end. In our study, lead-time is defined as the time it takes for the supplier to

deliver a product or part to Volvo. Lead-time normally consists of activities such as orders handling, set-up, processing and distribution.

Concept of process management: We define process management as a set of communicative activities to achieve a defined business outcome: to shorten the lead-time. By a communicative activity we mean, the use of networking to create relational contact with suppliers. Process management has two important characteristics; first it is oriented to suppliers. That is, process management has defined business outcomes in regards to the suppliers and suppliers are external to the firm. Secondly, process management can be redesigned between the computer network and a firm and their suppliers.

1.9 General outline

Our study starts with a short presentation of the background, problem, purpose, and delimitations.

Chapter two: We present our perspective on the methodology and method applied. We also intended to motivate our choice of method.

Chapter three: In this chapter we present our theoretical framework. We are going to give more attention to the nature of a specific management that promotes and emphasises associations with the environment outside the firm. This is an attempt, to develop new products, to renew the communicative process and to process flow of the supply and materials needed for manufacturing. The concept that we use for description of the supply flow is process management.

Chapter four: In chapter four we give a short description of Volvo with a specific focus on process management. We are also going to give a short presentation of the suppliers that we interviewed.

Chapter five: In chapter five we present our empirical material, from which we draw themes and concepts that we believe are relevant for identification of

process management. Further, we are going to interpret these themes by considering material that explains Volvos perspective. This is going to lead to an illustration of a re-structured model for process management.

Chapter six: In this chapter we are going to conclude and summarise our study.

In the previous chapter we discussed the problem and objective of the study. In this chapter, we focus on methodology and method that we intend to use throughout our study.

2 Method

Introduction

This chapter is divided into two parts. In the first part we present the open system perspective as our applied methodology. In the second part we present our method of interviews as a key way in which the research data are collected.

Part I

2.1 Methodology

An open system perspective

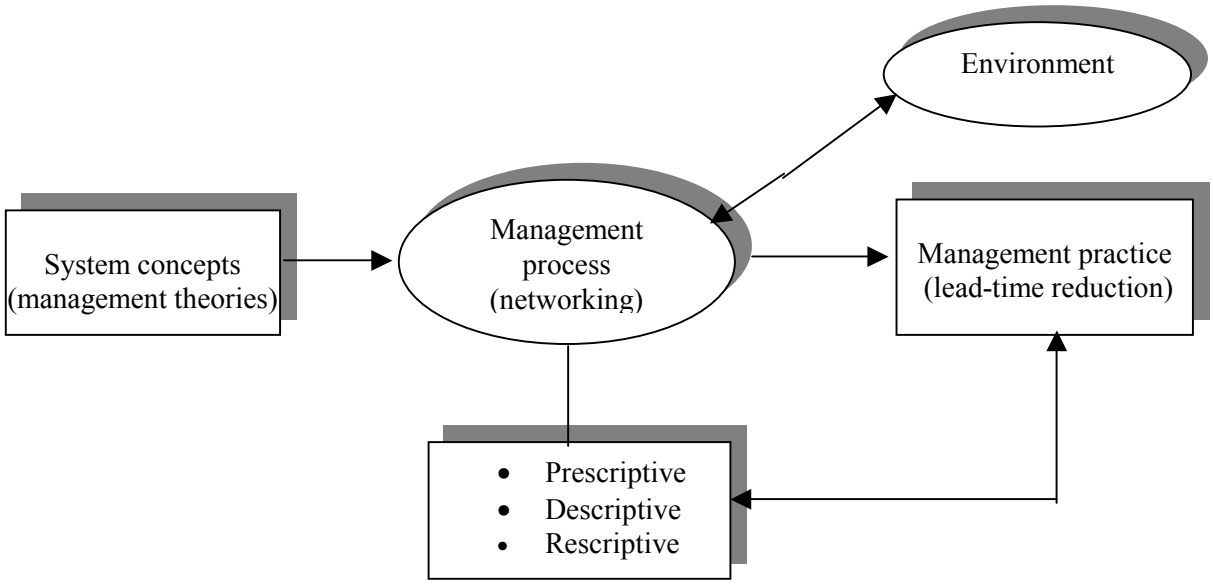
Let us, as an initial idea, define the process management in short. Process management is, in the sense that we understood, the process of creating relational alignment and sustaining corporate competitive advantage through reduction of lead-time. This definition involves (1) understanding and describing the context in which managers work (2) developing some proper and consistent communication tool and (3) implementing it to create relational alignment and sustain competitive advantage.

To achieve this, there is a need for a communicative system, which is sufficiently open (networking), which involves process thinking (relating the supplier to the production), and has an economic benefit (to reduce lead-time) that will lead to some beneficial outcomes (competitive advantages). Thus, open system theory can be seen as a metaphor (seeing something from the viewpoint of something else) that can best present the underlying ideas applied in the framing of our work.

The systemic relationships require interconnection between the basic concepts.

The following interconnected concepts would describe our research:

Figure 2.1, An overall framework of our methodology



In order to enrich the above-illustrated figure, we look at the system perspective, a methodology view, developed by Arbnor and Bjerke (1994). According to them, the perspective of the open system theory focuses on the dependency relationship between the external and internal factors. This does not mean that the role of actors in interpretation must be reduced, or their influence in these relationships should be decreased. Our view is based on the idea that actors must interpret the system, change it, and transfer it for the context of their own activities. The basic premises of the open system theory emerge from the notion that,

> "Reality is arranged in a way that the totality differs from the sum of the parts." (Arbnor and Bjerke, 1994, p. 72)

In a system perspective, relationships between the totality and parts are essential. But, first these parts and characteristics must be distinguished from the characteristics associated to the view of totalities. There is different logic that interconnects a system (the whole) with their parts. The main ideas of the systemic perspective that can be drawn from Arbnor and Bjerke (1994) are based on the concepts such as a change, adoption and agreement:

1. Change versus stability. Arbnor and Bjerke (1994) present change in three ways. First, as a variation of the environment. Second as a structural change, e.g. a permanent deviation from earlier relationships, and finally, as a pragmatically change observed in the environment.

2. Adoption to the environment. This means what ability the system has to adapt and look as the environment.

3. Agreements. Two integrated systems co-operate and support each other, and in this way they have an agreement. It is important to have equilibrium and this agreement can be a guideline for a new and better networking system.

In fact, this latter notion of change has implications in order to understand the management process that is assumed to interconnect suppliers with Volvo.

These concepts can support the study to show how process management is applied to support lead-time activities in practice. These three concepts are related to process management at Volvo. The first concept, change, is related to the initial stage if and when a company that supplies parts to Volvo is willing to adapt and change, as with EDI and EDI via Internet. The second concept is related to how well the EDI system and EDI via Internet can be adopted, within an organization as well as outside. The third concept involve that when different companies use a system between each other, certain agreement must be meet, so all parties follow the same guidelines.

In order to simplify this process, we are going to focus on three concepts that are often discussed in regards to the system perspective. These concepts are methodologically relevant for our research on process management. The concepts are; descriptive, prescriptive and rescriptive approach in order to understand process management (Carlsson, 1993).

2.1.1 The descriptive approach

The descriptive approaches call for the type of information in such a way that action, responsibility, and relationships of the operational activities in organisations are monitored. In achieving a viable system of networking, descriptive information about the operational works of suppliers and Volvo is needed. If this information is relevant and insightful it can form a viable basis for deciding to develop networking.

2.1.2 The prescriptive approach

The prescriptive approach shows management discretion. It indicates the activities and relationships, which are essential for attaining some chosen set of goals. Management knowledge, such as JIT and the use of EDI to reduce the lead-time, is the logic underlying this knowledge and is seen as a prescriptive approach.

2.1.3 The rescriptive approach

The rescriptive approach is a novel way to do process management. It simply means to take the knowledge and the experience of an expert and transform it to a representation that can deal with management issue. IT experts and skilful managers, who understand both the economic meanings of the lead-time reduction and networking, are essential.

Thus, institution of a process management is based on the systemic information that processes of descriptive, prescriptive and rescriptive methodologies can facilitate. Some of this information is only theoretically relevant, that in a systemic relationship is often named the general system. This system is built on different system classes that are built on different system structures. The structure is the important indicator in the general system theory.

The general system theory aims towards integration between the internal and external factors. The theory starts with components and parts, inside and

outside a company, which are assumed to be dependent on each other. In that, it is not management concepts, which are important- it is the unique characteristics of the Volvo management activities and features of their core competence, which are important.

Other information must be drawn from the context of organisations, which are at the focus of building process management. The last key information is dependent on the management skill and readiness to implement them. In a system theory, this latter knowledge is even named as pragmatic knowledge (Carlsson, 1993).

Part II

2.2 Method

Among many procedures suggested for collecting information, two of them have been emphasised more than others. These are interview methods and methods of document collection. Primary and Secondary methods of data collections are other names given to the same procedures.

Concept of primary data implicates the collection of information through direct observation, personal interview, and conducting conversation (Merriam, 1998). While, concept of secondary data means the study of documents, biographies, and other historical and documentary records relevant for description of the case at issue. There are positive and negative views about every method. Evaluations of any method were often related to the sources of errors, which are inherent to the methods in question. It is therefore important to try to consider each source of information on the basis of its own features. In interviews, for example, people's perceptions can be wrong, especially when they communicate the soft variables such as the human aspect of process management and management of knowledge. In studies of records, there can arise errors related to the categories of formality and needs for expressing these formalities.

Interviews are seen to be one of the most important methods for collecting non-formal, personal and brand new information. Therefore, interviews are considered equivalent with primary data collection. Thus, as a method interviews are both powerful and fragile. It is powerful because it supports collection of up-to-date and situational information, as it on the same hand is fragile, because it supports subjective, personal and situational variables. Both the situations and persons may be changed and information loses its validity.

2.2.1 Primary data

According to Dahmström (1995), gathering primary data can be done in two different ways. First, information can be gathered from personal conversations and interviews. One criterion to have successful conversations and interviews is that, participants have access to relevant information in which the research questions are targeted.

Personal conversations and face-to-face interviews increase the quality of information, by immediately asking complementary questions to get clarity about unclear issues. It is a quick way to reach the respondents and ask spontaneous questions concerning the subject and the interviewer can follow up on earlier asked questions (Dahmström, 1995). One of the disadvantages with face-to-face interviews is that, the respondent can build answers from own values and thoughts, not from the viewpoints of all persons within organisation.

According to Wiedersheim and Eriksson (1991), there are other advantages with personal conversation, for example, the interview processes can be more controlled and more complicated questions can be asked, especially if the respondent has received the questionnaire in advance. Moreover, pictures and other slides can be used if necessary and the respondent can follow up questions and use body language to explain better. It could also be difficult and time-consuming to arrange an interview.

Secondly, primary data can be collected from phone interviews and also from

e-mail. We use these methods for additions of our earlier questions, when complementary information was needed. In fact, on one hand phone interviews gives a high frequency of answers and follow up questions could easily be asked. On the other hand, they have to be rather straightforward questions and slides and pictures cannot be shown. Features of bodily communication will be missed out and it is also difficult to ask sensitive questions.

However, to receive information by e-mail is a fast and a preferable method, if you have a questionnaire with lots of alternative answers. E-mail is also good to use as a 'follow-up' method, in combination with a phone interview. The weakness is that it can take a long time until the answers are delivered from the respondents and also difficult to follow up the answers with further questions. There is also a risk of receiving a low answering frequency.

2.2.2 Secondary data

Another source to collect information is by secondary data collection. By secondary data Dahmström (1995) means there are several ways of collecting information, such as literature, case studies, articles or web sites etc. It denotes information that already exists on the subject, both empirical and earlier research. As mentioned above, one benefit is that data from earlier studies or research can be used in combination with primary data in a beneficial way.

However, there are a number of weaknesses with secondary sources. To mention some, first, according to Dahmström (1995), the research purpose may not be exactly the same as the new purpose of a study. Secondly, there is also a risk of getting old, or out of date, information from these sources. A third weakness is that data is not saved as it was from the start, it can depend on the fact that register have not been updated lately and become out of date.

We started our study by combining secondary material, with first hand information. We searched for articles in databases at the library, and used keywords like e-commerce, Internet, EDI, information technology etc. Articles, which included these keywords, were matched and we started to read the

articles. After reading about different subjects in the articles, we chose the theme electronic network exchange, since it would be an interesting issue to look deeper into. We contacted a couple of companies that were interested in the subject. We decided to write our thesis for Volvo and arranged a meeting with Lars Bolminger (who is purchasing director at Volvo) and discussed what kind of research could be of interest for them to do a study on. When an agreement was made between Lars Bolminger and us we started to search for further secondary material concerning our study, we searched for literature, books, case studies, articles etc. at the library. Keywords as: lead-time, suppliers, process management, electronic network etc. were used. After gathering literature we began reading, to get a better understanding of the subject. When we got a deeper knowledge of the issue that our study would be based on we selected, after discussion with Volvo, a couple of suppliers that we would interview. After receiving material from the respondents, suppliers and Volvo, we started to continue with our study.

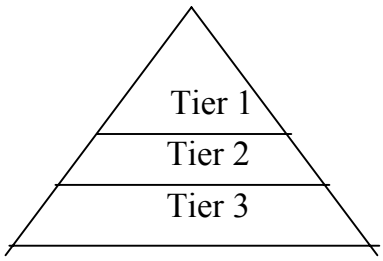
2.3 Why we chose interviews

In our study we based our information from interviews with the suppliers and personal at Volvo that have knowledge about the subject. We choose interviews because we believe that it is a good way to get relevant and useable information about the subject. Since the subject considers a new system that is in the initial phase, there are no experience data that we could use. We also believe interviews are the best way to get deeper up-to date knowledge since there are not much literature written about this area and we can get a better understanding how the traditional system works in reality. Although, we have used the literature that we found about the subject, and we also received information from Volvo.

2.4 Our interview techniques

We interviewed suppliers in three different Tiers, according to the figure below.

Figure 2.1 Suppliers in different Tiers to Volvo.



The different Tiers consist of suppliers that deliver parts to the Tier above. Suppliers in Tier 1 deliver parts to Volvo, and supplier in Tier 2 and 3 deliver parts to the Tier above or directly to Volvo.

Through discussions with Volvo, Volvo recommended us to choose 10-12 companies to interview. This is since it is better to interview fewer companies to collect fairer and deeper information about them. We did not take the size of the company into consideration when choosing suppliers.

From the suppliers that we chose, we decided to concentrate on external suppliers, since we believe that they are not as influenced by Volvo as their internal suppliers. We have interviewed 12 suppliers from three different Tiers: 1, 2 and 3, which have been selected on a 'random' basis. We wanted to se how perceptive suppliers in all of these Tiers were, to changing technology.

We choose to interview six suppliers in Tier 1. We believe this group is most likely to implement a new technology as EDI via Internet when it becomes available. This since if Volvo implements EDI via Internet, suppliers in Tier 1 will probably try to implement it, in order to communicate with Volvo in a more effective way.

We chose four suppliers in Tier 2, and two suppliers in Tier 3. We wanted to observe if suppliers, further down in the supply chain, would be affected too. However, since the system is not implemented yet, we believe that, the further down in the supply chain we interview, the weaker the answers could be, which also proved to be correct. So in relation to this, we decided to divide the

Tiers in to two different groups. Group one consists of Tier 1 and Group two consists of Tier 2 and Tier 3.

When carrying out the interviews, a couple of respondents required that they wanted to be anonymous. Therefore, we tried not to address any of the respondent's names in our presentation of the empirical material.

After deciding which suppliers to interview, we contacted them and arranged a date for a personal interview, although this proved to be difficult, since some persons that we contacted felt that they did not have the time to set aside, to meet us. In these cases we used a telephone interview instead. As a complementary, to both personal and telephone interview, we used e-mail, regarding questions that we needed more detailed answers to.

There are advantages and disadvantages with all of the methods mentioned. In fact, face-to-face interviews are in our opinion the 'best' method, since you can be in more control of, the direction the interview is heading. It is also easier to follow up questions with a face-to-face interview, since we believe it improves the conversation, to have personal contact. Another advantage with this type of interview is the opportunity to record the interview and listen to it again, in order to see if something was missed the first time.

In regards to the telephone interviews, we believe it was a bit impersonal since we did not have face-to-face contact, which is important in order to understand and interpret a person. On the on hand, it was a quite good method, since the persons we interviewed did not have to put aside as much time, compared to a face-to-face interview. In fact, answers were quickly delivered and follow-up questions could be asked, but since we could not see the person we were talking to, we could not interpret the 'body language'. Telephone interviews were a good method since deeper explanation could be given to get clarity on unclear issues.

Interview by e-mail is the least reliable method (Dahmström, 1995) that we used. It was fast, although, our experience is that it is not a good method since,

it sometimes took a long time before someone delivered answers to our questionnaire, and the answers were sometimes short and not explanatory at all. Since e-mail is not a high priority, it is often forgotten or put away for later, which means it can take a long time in order to get an answer back. We agree with Dahmström (1995) that there is always a risk with sending e-mail; that you get a low answering frequency.

2.5 Evaluation

There is always a question whether the methods used are appropriate or not, or whether other methods could have been preferred in order to lead to higher validity. The concept being used in the evaluation of how the transfer of concept and models to observations has been accomplished is validity and reliability (Merriam, 1998). Independent of what type of research it is, validity and reliability are questions that can be handled by giving very thorough attention to the basic concepts in the investigation and how you have gathered, analysed and interpreted your information. Validity is thus crucial for people who read a research paper and want to draw conclusions.

2.5.1 Validity

Validity answers the question of whether the instrument measures what we want it to measure. It tests whether the result of the research is in accordance with the reality. The reason why validity is a matter of discussion is that the researchers make their own interpretation of data. Yin (1994), talks about different kinds of validity, internal and external validity. External validity is to what extent the results from one investigation can be possible to apply to other cases. Yin (1994) say that a result must be tested or proved in another research project also in order to be able to generalise to a large extent. We are only focusing on internal validity, since this is the most relevant validity for our study.

2.5.1.1 Internal validity

Merriam (1996) states that internal validity concerns the question of whether your result is in accordance with reality. It is about how the information has been collected, how theoretical perceptions have been discussed and realised, and how the context has been observed.

We have tried to secure and enhance internal validity for our study by using existing theories that match our research. Another way in which we try to secure internal validity is by performing interviews with people that have expertise and experience within the information technology business, as well as suppliers that use this kind of information technology. A further step in this process, of securing validity, is to take both notes and recordings from the interviews in order not to miss any valuable information. To interview people face-to-face makes the interview more a discussion or conversation.

We increase the validity by means of, first, triangulation; which means emphasising different methods intended for collection of data. We used both interviews and documents as a base to improve our validity. Secondly, through feedback; we went through our questions and our written material with the respondents to eliminate misunderstandings.

2.5.2 Reliability

The reliability of the research findings is a measure of to what degree the findings can be replicated i.e. if the measurement process is free from random errors. Thus, if the research can lead to the same result if conducted a second time (Merriam, 1998). To achieve a high degree of reliability Merriam (1998) means that extensive documentation is needed. Because of the subjective nature of a qualitative case, there is always the risk that reliability can be limited.

There are, however, differences between validity and reliability. Formally, validity is seen to be depending on what has been measured and the relevance.

While reliability is determined by how the measurements have been performed. Reliability has to do with replication, i.e. that other researchers obtain similar results based on the same data. Question of reliability is, to some extent, irrelevant regarding our case studies. By this we mean, since our study focuses on interpretations of the questions that we asked, it is almost impossible to replicate those answers and use it for another study.

We will study the process management in Volvo believing that, such a system is unique for context of Volvo. Whereas, validity is considered to be more relevant. We invest our energy, to enhance the validity of our research rather than explain what validity is in more detail.

In the previous chapter we introduced the method that we use. In this chapter we are going to present sources of our theoretical inspiration. We attend to give more description to the nature of a specific management, relevant for the context of process management. Such a management constantly seeks association with the environment outside the firm. This type of management that we are going to focus on has an aim to renew the communicative process.

3 Theoretical Framework

Introduction

In the first part (part I) of this chapter, we present major features of process management in terms of relational capacity. In the second part (part II) of this chapter, we discuss the role of EDI, in assisting managers to achieve communicative capability for the firm. In the third part (part III) we discuss the role of the Internet. In the final part (part IV), we are going to emphasise the importance of networking in order to reduce lead-time as a communicative tool that operates for exchanging information between a company and its suppliers.

Part I

3.1 Associational domains of management

In order to develop a better understanding of innovation, manufacturing and customer service, we do not need to focus on the internal processes of the individual firm. We rather need to focus on the ensemble of relations in which firms interact. The ability of firms to create associational relationship is considered to be a part of process management. By means of process management firms seek to build more collaboration, internally and externally, with a view to become more innovative and to becoming more customers related.

Four spheres or domains play a major role in determining the overall activities in a company (Cooke and Morgan, 1998). These are process management,

Research & Development (R&D), production and supply chains. After a discussion with Volvo we believe these domains are relevant in regards to Volvo. This view, in our assumptions, has some theoretical bearing. For example, if we consider the area of process management, we can see that, many firms try to strike a better balance between the interest of managers and suppliers (Cooke and Morgan, 1998).

In the R&D sphere, all firms are under intense pressure to develop better links between their laboratories and their factories. In the production sphere, more innovative firms are trying to transfer responsibility to work teams who use their local knowledge in continuous improvement. Finally, the sphere of supply chain suggests that innovative capacity rests not so much on internal processes of the firm. We are further going describe in what ways all these four spheres are connected with each other.

Successful innovation depends on the associational capacity of the firm; which means, its capacity for forging co-operation between managers and workers within the firm and for securing co-operation between firms in the supply chain. The key issue in process management is the capacity to create and sustain a robust architecture for generating and using knowledge from a wide variety of sources, including employees, suppliers and public bodies; which is what we mean by associational capacity. From this perspective there is no sharp distinction between hierarchies and networks because the former are now nesting themselves in a wide array of inter and intra-organisational networks.

In process management, knowledge and learning play a key role. With the initiation of new competition, that is a shorthand way to signal accelerating technological change, shorter lead time, globalizing markets, tougher environmental standards, more knowledge-based products and services, it is not surprising to hear that ‘knowledge is the most strategic resource and learning the most important process’ (Lundvall, 1994).

3.1.1 Process management

Process management determines how companies balance the interest of managers, employees, suppliers and customers. As emphasised in the previous sections, we define process management as a set of communicative activities to achieve a defined business outcome: e.g. to shorten lead-time. By communicative activity we mean, the use of networking to create relational contact with suppliers. The innovative capacity of the employees, suppliers and customers are integrated into the core competencies of the firm and the process management concentrates on building processes that enhance collective relationships aimed primarily at creating knowledge and leveraging learning for the company.

General systems theory provides a sound, logical foundation for the concept of process management and this theory has been applied to productive systems. According to this theory, an enterprise can be viewed as an 'open' system;

> "An 'open' system is a system that interacts with and is sustained by its environment."(Arbnor & Bjerke 1977 p.83)

This interaction takes place in the form of information feedback. Thus, an enterprise is sustained by external inputs, such as market information, and uses various conversion processes to transform these inputs to outputs, which are end products or services.

Transformation is a key element of general system theory. An industrial operation can be viewed as a series of interrelated steps or activities, and each activity converts inputs as information, material, etc. into an output or work product that then becomes an input for the next activity. This series of steps is termed a process: a subsystem contained within the productive system. Thus, a system is composed of several interrelated processes or subsystems. Within any process, work typically flows in a serial fashion from one transformation step to another, increasing in added value as it proceeds downstream to the final operation (Davenport, 1990).

It is important to have a viable customer-producer-supplier relationship. With this relationship, an organisation's output must satisfy certain requirements that have been either accepted or negotiated between the producer and the customer. This applies to customers representing internal operations as well as to external, revenue-paying customers. Once the requirement phase is complete, the producer must, negotiate with the supplier to ensure that their inputs to the process are going to satisfy the characteristics of the output. In this way, emphasis is placed on meeting the customers and producers requirements rather than on allowing organisational personality and characteristics to dominate the workflow. Once barriers to effective workflow are reduced or even eliminated, the system can achieve significant improvements in quality and productivity.

3.1.2 Research & Development

Innovation is becoming dominated by 'teams of trained specialists' (Shumpeter, 1934) and it provides a critical mass of specialised skills through which firms can develop their distinctive technological competencies. As specialist groups are increasing, there is a danger of some essential channels of communication becoming attenuated or severe merely because of the presence of so many channels of communication around the suppliers. 'The fewer the links in the supply chain from development to production, the more important it is that, development and production learn each other's 'language', so they can become more effective. (Burns and Stalker, 1961). Instead of having intermediaries to give useful information, the suppliers can communicate directly to the R&D department and this can reduce lead-time.

It is important to have a close interchange of communication and information between product design and the suppliers. This makes them more productive when they can interact on a face-to-face basis. The quality of face-to-face interaction is higher than the electronic variety, even between people who know each other well (Lorenz, 1995). It is also important for the process management to integrate and use more cross-functional skills at each stage of the process. This integrated approach has set new standards in product

development, with the result that time and costs of development have substantially been reduced in the automobile industries. Companies are trying to reorganise their R&D functions closer to their suppliers, so that they become more integrated with the wider activities of the firm, especially production.

3.1.3 Production

A challenge for companies is how to respond to the Japanese model of lean production; a model to set new national benchmarks for product, process, and organisational innovation in mass production industries. Some of the key features are: integrated single-piece production flow, with low inventories and small batches made JIT, the production is pulled by the customers and not pushed to suit machine loading and close integration of the whole value chain from raw material to finished customer, through partnership with suppliers. Production and supply chains are areas in which trust building is most problematical.

It is sometimes argued that genuine collaboration is impossible in production and supply chains since power relations are so asymmetrical between firms and suppliers on one hand and between customer and firms on the other. The important point is that, asymmetry does not preclude collaboration, in supply chain partnerships, the customer is clearly the dominant partner, and supply chains are closer than markets.

Supply-chain partnership is described as a high priority, which large firms are beginning to accord to their suppliers. The traditional arm's-length contracting relationships are at best ineffective and at worse a liability if firms wish to develop and sustain a capacity for innovation, learning and quality. In the former, contract relations tend to be characterised by low-trust, short-term commitments, limited information exchange and concentration on price, while in the latter there tends to be high trust, long-term mutual dependence, and considerable sharing of information technical know-how and risk. It is important to have a close relationship between the production department and

supply chain, since if the information can be delivered faster it will result in reduced lead-time between these parties (Cooke and Morgan, 1998).

3.1.4 Supply chain

In the era of the new competition the 'make or buy' decisions is proving to be one of the most important, precise, and indeed frightening decision a firm can make, not least because it defines the boundaries and core competencies of the firm. Time was when large firms saw just two options for the production role, either they produce their key parts in house through processes of vertical integration or they procured their parts through contracts with external suppliers. The limitations of only these two options, have forced firms to explore the potential of a third option, namely supply chain partnerships, a variant of network form of organisation (Cooke and Morgan, 1998).

Accelerating technical exchange and intensified competition have persuaded many firms that bid on price. The result was very often fear, mistrust and mutual frustration (Cooke and Morgan, 1998). Supply chain partnerships, by contrast, are based on the assumption that both parties can gain more through co-operation than by separately pursuing their own short-term interest. Arm's length contracting is based on the assumption that two parties to the contract were adversaries: hence the limited information flows, the frequent switching to keep suppliers 'on their toes', and the inordinate emphasis.

Supply chain partnerships presuppose a measure of 'goodwill trust', which means, the confidence that the other party makes an open-ended commitment to take initiatives for mutual benefit and refrain from opportunistic behaviour. It also involves an agreed framework for jointly analysing costs, determining prices, and sharing the savings, an incentive structure, which makes for collaborative rather than adversarial contracting relations. Trust has to be built in relationship, customers may be the dominant partners, but recent outsourcing trends suggest they are becoming more and more dependent on their key-suppliers. To build high trust relations with its suppliers is essential, since they can share information more freely to reduce the lead-time and costs.

Supply chain partnerships have enabled Japanese car firms to reap the benefits of the vertical integration without bearing costs. To have few suppliers gave the firms a chance to gain more from these partnerships, it is argued that both purchasers and suppliers benefit from the synergistic effects that accrued from joint problem solving and continuous improvement in price, product quality, delivery, design and reengineering (Nishiguchi, 1994).

Firms are becoming more conscious of the fact that their capacity for innovation, learning, and quality depends on their ability to secure the active co-operation of their suppliers. The greatest barrier to the supply chain partnership is the divergence between rhetoric and reality. To be effective, a supply-chain partnership has to have, as we mentioned before, a good balance of trust where the benefits flow in both directions. Although, trust based partnership can be difficult to construct, not least because trust has to be earned rather than decreed, they constitute intangible assets, which the more innovative firms recognise to be every bit as important as tangible assets.

Part II

3.2 Functions of EDI

EDI was found in the early 1970s and stands for Electronic Data Interchange. It is an electronic exchange of common documents such as purchasing orders, invoices and funds transferees from businesses to businesses. EDI plays an important role in improvement of process management and allows companies to exchange data through computer-to-computer transactions. This improves the efficiency of ordering, billing, and cutting down errors that would happen more commonly in communications by paperwork. Because EDI provides more timely information for making decisions, more transactions can be completed without increasing the staff. Also, through more use of EDI technology, managers will have more time for professional activities because of the time saved using EDI.

> ”Time reduction is a major factor of the EDI system.” (Dykert et al. 1992 p.15)

In order to reduce the amount of capital in each work situation, companies can reduce their inventories; increase the speed in production etc. To succeed with this they need better data communication both internally and externally. To speed up the process, companies no longer have time to convert information to and from paper documents. Computers must be able to communicate directly between each other, which the EDI system does (Dykert et al, 1992). A main reason for adopting EDI has more to do with growing partnerships with customers and integrating the company seamlessly with their supply-chain.

EDI can work in combination with VANs or X.25, which is a package deal network service. There are X.25 networks in most of the countries in the world and they are quite easy to connect between the different operators that use X.25 services. A package deal means that information is put in to an ‘envelope’ or ‘package’ which is sent on public lines to the receiver. Volvo uses X.25 to communicate with several parties at the same time. This means that, with X.25 it is possible to have parallel sessions, a high availability abroad and also a very high reliability (Fredholm, 1992). One of the disadvantages with X.25 is the relatively high cost.

Many corporations, especially those with multinational networks, have the X.25 packet, since it is widely available and reliable. Analysts say that X.25 is more cost-effective for companies that have a lighter data load (Girard, 1997).

3.2.1 EDI and its strengths

The advantages of EDI for large businesses are many; one example is that it reduces the cost of generating business documents dramatically. The discipline and change that result from planning and implementing EDI often increase efficiency in company operations, thereby improving revenue. Accuracy and control of interactions with trading partners are enhanced if they use EDI and it

significantly improves the bottom line for those enterprises that can afford to implement it fully.

EDI also improves the information flow among all trading partners. The costs of paper and mail are considerably reduced. Companies save time by not having to re-key information into computers and also by not having to fill out stacks of paperwork. Also because of the electronic payment procedure, errors and delays are significantly reduced. This in the long run reduces the overall cost of payments. Despite its costly start-up and operational expense, EDI is cost effective for large enterprises that generate enough volume to justify its use. Electronic Data Interchange is an exciting technology that can be very helpful to large companies as well as small businesses alike. EDI can save companies large amounts of money by reducing paper trails and saving them valuable time to do other important tasks.

3.2.2 EDI and its weaknesses

EDI was designed to enable businesses to transmit and receive data via standardised messaging formats and element dictionaries. In some environments it is a great solution, but EDI does have its limitations. For one thing, it is expensive to implement, and the implementation process can take a very long time. Hence, EDI has historically been an option only for large companies that could spend a lot of money on it (Borck, 2000). The cost does not stop piling up once the EDI system is installed. EDI requires a secure, dedicated leased line e.g. VANs, which means that playing outside the corporate ‘sandbox’ on an EDI network, can impose substantial connectivity expenses. The EDI program is expensive and so are the leased VANs. To cut these costs, many businesses transmit their EDI data only periodically. But of course, this practice limits the tool’s real- time effectiveness in business-to-business scenarios.

Part III

3.3 Internet

The Internet is simply conducting commerce electronically and the new infrastructure is intended to join all the large and small companies via the industry's central EDI Web site. This is making it possible for all manufacturers, traders, distributors, processors and users to share a common database, from orders and production plans to inventories and logistics (Furukawa, 2000).

The main technologies for processing business transactions electronically, today, are often executed by means of EDI (Fellenstein, 2000). Internet technologies are now highly standardised and capable of performing most types of transactions. The use of Internet in a business-to-business context appears to be rapidly gaining momentum. The topic of e-business will often include business-to-business process automation, which means that, some have stressed that e-commerce is nothing more than a fundamental way of processing business transactions between buyer, sellers and suppliers.

Internet e-commerce transactions satisfy the need for businesses to manage trade, while leveraging across Internet many specific Internet e-commerce with exchange of business-specific data like purchase orders, manufacturing, invoicing, shipping documentation, billing and other accounts receivable information (Fellenstein, 2000).

The 'new way' of EDI means that companies can place orders directly with other companies via Web sites. This way of EDI is proving to be a better form of transferring the information. Internet based EDI can broaden the market. Using EDI via Internet can help reach suppliers that the regular sales staff might not be able to contact. A customer can sign on Internet, enter an order, and transmit the order using EDI, reaching a broader base of suppliers and customers. Registering an order directly bypasses the problems of getting two

different computer systems to connect. Internet also eliminates the telephone rates involved in non-Intranet transactions saving more money.

3.3.1 Benefits with EDI via Internet

If a company wants to expand their EDI network and decides to invite other members into their ring of business partners, it would be an advantage if these new members already have EDI set-ups, otherwise it could be very expensive for them.

When expanding an EDI network, the costs do not have to be prohibitive. One way to save money is to shift the actual data transport from more costly private networks to Internet. New technologies as VPN (Virtual Private network) enable secure delivery without breaking the bank. VPN is particularly effective because it uses Internet as a vehicle for receiving and delivering data, rather than dedicated, leased lines. A VPN box stands between internal network and Internet at each end of the connection. When using a VPN to transmit data, the data disappears from the surface at the sending point, re-emerging only at the destination point, and a process known as 'tunnelling'. As its name suggests, the tunnelling method creates a logical pipeline across the Internet that connects two locations. According to tunnelling, private information is invisible to other Web citizens. The current state of VPN technology is advanced enough to provide flexibility for future network expansion, while maintaining high reliability and security (Apicella, 2000).

3.3.2 Security considerations with Internet

Internet-based communications also come with some drawbacks, most notably the fact that they are exposed to potential breaches of security and confidentiality. When using Internet as an extension of the companies' own network, information is sent along public pathways, and anyone who can tap a protocol analyser along the way can easily intercept the data. This can be compared to postal system without envelopes.

Business partnerships, by today's technologies, for sharing data and applications make it easy to overlook the security issue. Security systems that were previously used to shield corporate resources from outside invasion must now be opened, if even slightly, to let in partners. But the use of EDI does not preclude the securing of the transport mechanism.

Hence, in light of exposed access afforded business partners, all sides must agree on consistent levels of security and access control. A company must analyse their partner's security framework to ensure compatibility, and if they find that it is substandard, demand compliance or move on. A breach in a partner's security will directly affect the company's customers.

All business partners should invest some time in developing firm contingency plans in the event of a security breach and should be committed to full disclosure of such happenings. Furthermore, a company's plans should detail specific measures to help minimise security threats without compromising revenue. For example, a partner who unadvisedly takes down links while a security hole is being sealed could create unexpected and potentially substantial revenue losses to other partners.

When considering Internet security techniques, securing electronic processes (SET) are essential to have in mind. SET alone, however, addresses only secure payments. It does not cover overall security. Organisations seeking a centralised solution to security could implement a public key infrastructure to combine all aspects of an enterprise wide security plan. Public key infrastructure supports all tasks associated with digital certificates, including encryption, authentication, digital signatures, key management, non-repudiation, and cross certification. When the initial complexities and costs are overcome, however, public key infrastructure can reduce administrative overheads by centralising the entire security apparatus (Cashin, 1999). By utilising Internet-trading techniques, transaction costs are less expensive than those associated with telephone-based salespeople.

3.3.3 Cost advantage of Internet trading

During the past several years' implementations utilising various methods of Internet far surpass those more traditional telephones and fax machine methods. Corporate executives are rapidly moving to Internet methods to leverage Internet with a clear objective: to reduce costs of operations and improve the effectiveness of their sales force. The end result is to capture more business orders, which, in turn yield more corporate revenues and to reduce lead-time (Garcia, 1995).

Part IV

3.4 Lead time

In a more turbulent environment, with rapid developments in information, technology, globalisation, increasing international competition and more sophisticated and demanding customers and increasing speed in life cycles and processes, industries must challenge these new uncertainties. The changing situation for manufacturing, with an increasing amount of engineering and administration (Johnson and Kapland, 1991) influences what activities can be subject to improvement.

Today, speed is of the essence and competition among manufacturing companies is becoming more and more time based. In addition, there is a growing awareness of speed and time as resources of competitive advantages. The purpose of improving time performance is to gain a competitive edge that contributes to an increase in profitability through higher customer service, reduced costs and less inventory. Time is a resource that contributes to both long- and short-term success. This means that time is not unlimited and free, since it is related to both cost and inventory. Therefore, the time spent, both in material flows and for administrative activities, has to be reduced (Stalk and Hout, 1990).

In the traditionally oriented type of manufacturing, shop floor activities in production were focused upon for measurements and improvements. Today all activities are subject to lead-time improvements, shop floor activities as well as order handling, planning, delivery and R&D. There are numerous models and descriptions of how focuses have changed over the last decades. In the 60s there was a strong cost orientation, in the 70s customer services was in focus, in the 80s, it was inventory and quality and in the 90s it was time and human aspect that were emphasised (Wedel 1996).

The definition of lead-time can vary; depending on what part of the company is focused upon. It normally includes all activities from start to end. In our study lead-time is defined as the time it takes for the supplier to deliver a product to Volvo. Lead-time normally consists of activities such as orders handling, set-up, processing and distribution. It is easy to understand and measure, because time is something frequently used in all kinds of situations. One solution to shorter lead-time can be to achieve a quick administration and manufacturing or by the use of inventories of finished goods. The second solution can however, be inefficient because it creates inventory and costs. Short lead-times can instead be built on short cycles for order handling, manufacturing etc. (Wedel 1996).

The negative effects of long lead-times are several. Uncertainty is exponentially affected (Mather, 1998), which increases the business risk. Delivery dependability, which is increasing in importance through increased demands for inventory free, manufacturing concepts, is affected by uncertainty. Long lead-times therefore, indirectly affect the delivery dependability. Inventory is affected by time, since it is proportional to some parts of the lead-time (Person and Virum, 1996). Short lead-times can be reached by the use of large inventories of finished goods. However, since there are also goals for low inventory, the use of made-to-order control principles flow orientation has been stressed. Other factors that are negatively affected by time are flexibility, resources needed, scrap rates and other quality connected issues. Improvements for shorter lead-times in manufacturing are defined as planned change aimed at increasing efficiency and effectiveness.

Lead-time in manufacturing includes both running processes faster and eliminating waiting time between activities. Lead-time, i.e. the time from order to delivery, expresses the waiting time for customers. In this perspective lead-time should be minimised. The situation is a little bit more complex from a manufacturing perspective since short lead-times mean fast flows but on the other hand resource utilization and cost can be negatively affected e.g. by the use of flow orientation, which reduces lead-time but decreases utilization in mixed production.

Lead-time is one of the main competitive factors among companies. The ability to deliver quickly influences sales and thereby revenue. If a reduction is made e.g. with a low degree of inventory, profitability is positively affected in two ways. The competition aspect is especially important when competitors make major improvements. Stalk and Hout (1990) show that companies competing on time have better growth and profitability than their competitors.

New management trends are easily adopted among companies. One of the trends in recent years is lead-time reduction. The probability that companies have adopted the idea of lead-time reduction and used it in their business is therefore high, especially in Swedish industry, which in many ways is considered to be progressive, using new ideas (Wedel, 1996).

3.5 Conclusive remarks for our theory

In this chapter we have emphasised on theoretical literature that is relevant in regards of Volvo. We are briefly going to sum up the theory we used.

Firstly, we present major features of process management in terms of relational capacity that we believe are important in the process of lead-time reduction. In regards to Volvo our theoretical framework show the importance of how different concepts within process management has to be connected with each other to achieve a reduction in lead-time. Communication between parties is important, where learning, innovation, and unspoken knowledge are essential. To redesign process management at Volvo communication has to be

considered. Since technologies and markets are less stable and standardised a new style of management can have a significant role to play.

Secondly we have explained the function of EDI, its strengths and weaknesses and also X.25 is related to EDI. Since it is a major concept in our study we wanted to state for readers that are not familiar with the subject what EDI.

Thirdly, we have described Internet and its benefits and costs, but also the security by using Internet. Since EDI via Internet is not yet in operation it is difficult to find much information of the subject. Although, we have given a briefly introduction of what the pros and cons of Internet are.

In the former chapter we describe process management in terms of relational capacity. We also discussed the role of electronic network, in assisting managers to enhance communicative capability for the firm. In this chapter we are going to emphasise process management in Volvo, and also give a brief introduction to the suppliers that we have interviewed.

4 Presentation of Volvo and their suppliers

4.1 Volvo Group

The Volvo Group was founded in 1927 and has today 55,600 employees, production in almost 30 countries and a worldwide marketing organisation. Volvo is one of the world's largest producers of trucks, buses and construction equipment and holds a leading position in the fields of marine and industrial power systems and aircraft engine components.

4.1.1 Process management at Volvo Car Corporation

In the Volvo Group, changes are constantly taking place. Increasingly fierce competition results in more rigorous quality requirements and the constant pursuit of lower costs. In order for companies to stay competitive and successful, process management is an important concept in any organisation. (Porter, 1986)

After having a conversation with Maria Forssell, process design and IT manager at Volvo, we got a more in depth knowledge about how process management works at Volvo; what concepts they believe are essential and how they work with these concepts. In relation to lead-time when ordering parts, Maria Forssell explained that delivery precision is very important. Parts need to be delivered at the right time, and contain the correct quantity ordered.

The JIT system that is used at Volvo works well as long as parts are delivered at the right time and of course contain the ordered quantity. Although, if

something went wrong with the delivery, they have a small amount of buffer stock, so they will never be without any required parts.

Since lead-time is important for Volvo, the whole process from order time to delivery must be planned carefully. Suppliers must receive their order in time and the transport of orders must be planned. At the plant all parts must be in the right place at the right time.

When risk was brought up in relation to the function of EDI, Maria Forssell said that, the EDI system was secure and Volvo IT has the responsibility to keep the system safe and up to date. Although not all information is sent with the EDI system, but information that is classified e.g. prices and drawings are sent with the EDI system since it is a secure system. Lars Windeman, state that;

> "Volvo Car Corporation uses EDI in combination with X.25 and this is a secure system."

As the statement above explains, Volvo uses a net service called X.25 together with EDI, this system works with information that will be put in a 'package' and sent to suppliers. A company can communicate with many suppliers at the same time, on one line, due to the service X.25.

Volvo has also implemented EDI communication in accordance with the EDIFACT (EDI For Administration, Commerce and Transport) standard with their suppliers, and between the various departments within the Volvo Group. EDIFACT can be compared to a language that makes computer programmes understand each other no matter what type of computer or operative system is being used. The technology is progressively introduced, and will apply to all suppliers and departments within Volvo.

Although, if EDI via Internet is implemented, Lars Windeman mentions that security would not be as good as with the traditional EDI, since it is not completely safe to send information via Internet.

The role of expertise is valued highly at Volvo, knowledge and skills are a competitive resource to them. Collaboration with Information Technology expertise is also essential in Volvo. Volvo has taken advantage of their knowledge and expertise. As Ulf Nilsson, President of Volvo IT states;

> "The continuous development of skills and expertis*e* is essential if we are to continue to be a competitive partner in the future."

Another aspect that is important to Volvo is to have good relationship with their suppliers. Volvo has an extended enterprise with partners. The partners are selected suppliers that are required to use EDI. The closer a company and its suppliers can work together the better the communication can be. Maria Forssell also mentioned how important it was to have a 'trust relationship' with their suppliers and to keep an open dialogue with them, this way both parties gain.

Volvo continuously tries to improve the way they do business, and constantly looks for new opportunities that can benefit them. They are now aiming at what they call 'the new economy', with this they mean that they are facing towards 'e-business', which is electronic commerce. According to, the web is fast, reliable, secure and accurate and these keywords are all related to give a better communication between companies and their suppliers.

4.2 Brief description of Volvo's suppliers in the different Tiers

Out of the suppliers that we chose, we decided to concentrate on external suppliers, since we believe they are not as influenced by Volvo as their internal suppliers. We interviewed 12 suppliers from three different Tiers: 1, 2 and 3, which have been selected on a 'random' basis (see section 2.3).

We will give a brief presentation of who the suppliers are, when they were founded, what kind of products they make and what their vision is. First, we give a description of suppliers in Tier 1; then suppliers in Tier 2 and finally the suppliers in Tier 3. The suppliers in Tier 1 that we have interviewed are:

Autoliv AB, Bosch AB, Bulten AB, Continental Gislaved Däck AB, Forsheda and Lear Corporation.

4.2.1 Autoliv AB

Autoliv AB started its seat belt operations in 1956. The company has six major products that they are working with, these are; frontal ad side-impact airbags, seat belts and seat belts features, high adjust-adjusters and belt grabbers, seat sub-systems, steering wheels and rollover protection. Their business idea is to develop, produce and sell systems worldwide for mitigation of injuries to automobile occupants and avoidance of traffic accidents.

4.2.2 Bosch AB

Bosch AB was founded 1904. Their products are automotive equipment and automotive products, car audio and navigation, heating systems, household appliance, power tools etc. Their vision is to give a wide range of products and technologies with a worldwide reputation for the highest quality and reliability.

4.2.3 Bulten AB

Bulten AB was founded in 1873 and its headquarters is situated in Hallstahammar, Sweden. Bulten AB develops, produces and sells fasteners in farmer steel, wire steel and alloy steel and also stainless steel, heat-resistant steel and thermo-proof and oxygen-proof steel. Bulten AB is today divided into three different business areas; Automotive- Electronic- & Telecom- and General Industry. Bulten AB's ambition is to become more transparent in their communication with their investors.

4.2.4 Continental Gislaved Däck Sverige AB

In 1905, Continental Gislaved Däck Sverige AB started its business and in 1990 they joined the Continental group. Continental Gislaved Däck Sverige

AB is the main brand with a broad variety of tiers for all kinds of automobile types. They produce several different kinds of tires e.g. for trucks, busses, and cars. They also produce industrial, motorcycle and bicycle tiers. The brand today produces car tires for summer and winter, and also tires for light trucks and minibuses. Continental Gislaved Däck Sverige AB is well known for effective and secure winter tires.

4.2.5 Forsheda

Forsheda was founded in 1946 and a supplier to the industrial, aerospace and automotive markets. They also have a range of elastomer sealing products for critical engineering applications. Their core product range is; airbag cushions, airframe seals, diaphragms, gaskets, hydraulic seals, pipe seals, rail gangways, rubber/metal/plastic composite seal and shaft seals.

4.2.6 Lear Corporation

Lear Corporation was founded in 1917. They produce seat systems, door and trim systems, instrument panel/cockpit system, overhead systems, floor and acoustic system, electrical and electronic distribution systems and safety systems. Their aim is to establish the highest industry standards for quality, value, service and technology.

We have also interviewed a set of Tier 2 suppliers. These are Hydratech AB, Loctite Sweden AB, Tibnor AB, and Ulinco AB.

4.2.7 Hydratech AB

Hydratech AB was founded in 1986 and they construct and manufacture hydraulic systems and also modernize and repair hydraulic systems, presses and other hydraulic and pneumatic machines. Hydratech AB's aim is to improve and take on all kinds of hydraulic and pneumatic assignments to be in order to improve their competence.

4.2.8 Loctite Sweden AB

Loctite Sweden AB was founded in 1953. They manufacture and market a broad range of high-technology sealants, adhesives and coatings. Loctite Sweden AB's vision is the continued development of a company with global reach, capable of penetrating each market within that reach, and producing steady profits and sales growth over the long term.

4.2.9 Tibnor AB

Tibnor AB evolved from Söderberg & Haak, which is a company that started in 1866. Tibnor AB is a company whose core products are steel. Their main products are bars, tubes, hollow bars, girders, and heavy plates. Their goal is to be industries leading partner in supplying steel and metal in the Nordic countries.

4.2.10 Ulinco AB

Ulinco AB was founded 1981 and have five different kinds of product groups. They are Ulinco plastic, rubber, maintenance, covertech and fasteners. Ulinco AB is aiming to be a fast and polite supplier of components, details of consumption and services to the Nordic manufacturing industry.

The group of Tier 3 suppliers are: Nedschroef Holding N.V and TermoRegulator.

4.2.11 Nedschroef Holding N.V

Nedschroef Holding N.V was founded in the beginning of 1900 century. They produce fasteners, hot and cold heating machines and tools. Their mission statement is as a 'full service' supplier fulfills the needs of the automotive industry including suppliers to the automotive industry and supplying a complete range of fasteners for the most demanding applications.

4.2.12 TermoRegulator

TermoRegulator was founded in the 1950s. They work in the business area of making sheet metal work and specializing in thin plate machine. Their business concept is to undertake all aspects of production from initial idea to finished product.

Table 4.1 This table shows a basic overview of the companies we have interviewed, stating the contact person's name, what the company produces, what kind of communication system they use and what relation they have to Volvo.

	Company name	Contact person	Product	IT facilities	Relationship With Volvo
Group 1	Autoliv AB	Clas-Göran Yngve	Seat belts, steering wheels etc.	EDI	Tier 1 supplier
	Bosch AB	Anders Johansson	Power tools etc.	EDI	Tier 1 supplier
	Bulten AB	Rosemary Johnson	Fasteners	EDI	Tier 1 supplier
	Continental Gislaved Däck Sverige AB	Ove Burgesson	Tires	EDI	Tier 1 supplier
	Forsheda	Matti Taskinen	Rubber/metal/ plastic composite seal etc.	EDI	Tier 1 supplier
	Lear Corporation	Hans-Ove Abrahamson	Seat and safety systems etc	EDI	Tier 1 supplier
Group 2	Hydratech AB	Jani Juntunen	Hydraulic systems	Switchboard	Tier 2 supplier
	Loctite Sweden AB	Åsa Berntsson	Sealant, Coating	EDI	Tier 2 supplier
	Tibnor AB	Dick Svensson	Steel	EDI	Tier 2 supplier
	Ulinco AB	Susanna Ljung	Plastic, rubber	EDI	Tier 2 supplier
	Nedschroef Holding N.V	Carina Berglund	Fasteners, Tools	EDI to large customers	Tier 3 supplier
	Termoregulator	Stefan Liminga	Metal work	EDI to large customers	Tier 3 supplier

In the last chapter we gave a description of Volvo's process management and also a brief introduction to the suppliers that we interviewed. In this chapter we are going to analyse the answers we received from the suppliers. We also try to make an illustration of a restructured process management model, and we finish off with conclusive remarks.

5 Presentation and analysis of empirical material

5.1 Presentation of empirical material

We addressed three questions in chapter one in regards to the concept of process management, these questions are:

1. What is the role of electronic network exchange in structuring a new process management between Volvo and its suppliers?
2. How may an approach by EDI and EDI via Internet, be interpreted by the different Tiers?
3. In what way may electronic network exchange support the design of new process management?

Our questions in the questionnaire are in relation to the research questions above (see appendix). The questions are related to the function of EDI and in regards to lead-time reduction. We choose the questions that we believe are the most relevant for this study; we wanted to see if and how lead-time would be influence in different ways when applying electronic network exchange. To present our empirical material, we chose to use a thematically derived framework. The themes that we are going to concentrate on are structured by a number of relevant concepts, which are significant in order to understand and analyse the concept of process management. Thus, with themes, we mean to work with key concepts that are used by respondents to describe their interpretation in terms of e.g. lead-time and speed etc.

We focused on change in a communication system, by asking questions about EDI as a medium for communication. How this system works within

companies if EDI is used as network. We also focused on functions of EDI via Internet and what affects can appear in relation between a company and its suppliers. Other factors have also been considered but our main focus is to find out if lead-time can be influenced by an implementation of changing communication.

In order to get a broad and correct view from the supplier that we interviewed, we chose to question suppliers in Tier 1, Tier 2 and Tier 3. Taking into consideration the suppliers different views of the concept of lead-time, some of the answers to our questions were briefly given, while other answers were more broadly formulated. In the course of our interviews, sometimes the setting of the interview was transformed to the setting of a discussion in which everybody who was present tried to contribute.

We focused on themes that respondents found interesting and important in regards to process management and we have emphasised these concepts. We have addressed the concepts according to the answers that we received from the respondents. Thus, the concepts are derived from the context of interviews and discussions that have been carried out:

1. Lead-time
2. Less Inventory
3. Risk
4. Information technology
5. Use of EDI

We have divided the suppliers into two groups, Group one and Group two. We try to make distinctions between the different groups since we believe they have different views and opinions on the above concepts, depending on the relationship that has developed with Volvo during several years.

Beside this, in the presentation of our empirical material we, as much as possible, emphasised the notion of answers related to the respondents in respective group**.** Group one consist of Tier 1, and Group two include Tier 2

and Tier 3 together. Each Tier, supplies products or parts to the Tier above or sometimes directly to Volvo. We would like to emphasise the notion that sometimes it was very difficult for us to find out to what extent meanings and attributions of the above-specified theme can be related to respective group of supplier.

5.1.1 Lead-time

The first theme that we extracted from the context of interviews is the notion of lead-time. We asked the suppliers a number of questions emphasising this theme, which is important in understanding EDI and its function. How EDI - or EDI via Internet - can affect lead-time, and also what the consequences can be. It is easy to understand and measure, because time is something that is frequently used in many different situations.

According to the response delivered by most of the suppliers in the first Group, lead-time can be influenced if EDI is operated through Internet. In that case the use of a conventional method of communication (EDI system based on VANs) has been abandoned, or is not used as much. Some of these influences can be interpreted from the focus of this quotation, as a supplier in Group one stated:

> "By means of Internet we can send out order changes or new plans etc. faster to suppliers. This means that we do not need to keep a lot of goods in stock that are not going to be used. We can also receive components and parts earlier if something unpredictable shows up by using Internet."

In contrast to this quotation, a few other suppliers in Group one expressed the idea that their lead-time will not be influenced substantially. They said that they are used to working with EDI and that it does not make sense to them to assume that lead-time can be affected if the EDI system is going to be used via Internet. They also believed that these suppliers that do not have EDI must change their routines and become more 'flexible in adopting EDI'.

Even in Group two there are different opinions when discussing EDI via Internet. On one hand, some of the respondents believed that it did not matter if EDI or EDI via Internet were in operation; the lead-time is a matter of operative activities, not communication, which is fixed and cannot be changed. On the other hand, other suppliers in Group two believed that lead-time can be reduced if Internet is used effectively. It seems that the respondents have different opinions about this.

Wedel (1996 p. 6) has made a comment about reduced lead-time, he state that:

> "Reduced lead-times increase efficiency and reduce inventory, which gives competitive advantages and possibilities for price rises. Shorter lead-time does not have to mean running the operations faster, but working in a more efficient way and eliminating all waste."

We believe this statement is relevant because it supports that, if less capital is tied up in products and parts, then capital can be used for other resources instead.

Cost reduction is an issue that Group two was interested to discuss. They emphasised the major effect of network communication on the pattern of cost. One of them told us that:

> "Volume of selling would be increased, and through this we have the possibility to reduce cost."

A supplier in Group one discussed in a more rhetorical fashion that:

> "To reduce lead-time is a powerful strength, companies in today's environment need to be doing well in this area in order to be successful."

We try to draw the attention of the respondents towards problems and issues, which are related to the company they are working at. But we found that, they were more interested in general questions rather than practical ones.

In general, we can say that, our respondents agreed on the matter that a reduction in lead-time when using EDI via Internet could lead to competitive advantages for the suppliers. They believe competitive advantages are important but they find it difficulty to connect it with the issue of Internet network. We did interpret that in regards to the answers to our questions, respondents in both groups have a tendency to refer, to a more rhetorical discussion. One reason for this can be found in the matter that operation of EDI via Internet is in the initiation phase and respondents avoid answering in more concrete terms about the advantage and disadvantage with the system.

There would be no difference, focusing on speed when receiving information, if EDI or EDI via Internet were in operation. Group one agreed that adopting another technology would not change the rapidity of receiving or delivering information. However, there were different opinions within Group two in consideration of speed. A few suppliers said that they did not know what affects could appear, since they are not really aware about what is meant by EDI via Internet. Others assumed that speed would be slightly affected, since the bottleneck is not in the external communication, it is in the quotation in the system. While others emphasised that speed would probably be a little bit faster when using EDI via Internet.

To have good relationships with suppliers and customers was another factor that was emphasised several times during the interviews. As a supplier in Group one state:

> "Good relations between Volvo and us are important in order to do businesses and develop a future plan. For achieving these we both need consuming customer information."

From having made an analysis drawn on the themes of lead-time, we can draw the conclusion that, respondents relate to different factors, which may have

direct or indirect effects on the lead-time, to describe lead-time. From the concept lead-time, we have identified three key concepts or ideas. These are:

- Less capital to lock in
- Speed in relation to information
- Trust relationship

It is, more or less, taken-for-granted that by means of managing lead-time, suppliers can reduce bounded capital. The less goods in stock, the less capital to lock up, and this will lead to a reduction of the cost of capital.

Our contact with Volvo contributed to the idea that, nowadays companies acknowledge the importance of time more than before. For example, as a factor of time, there is a sense of consciousness in Volvo that 'speed' is to be enhanced, and therefore network, as a mechanism, is considered vital to get and deliver information in a fast way. Speed awareness in relation to information is mentioned several times by the respondents too. Based on this, we conclude that speed in relation to information is a key factor in a competitive environment.

However, speed in relation to information may also increase the cost, in terms of raw material consumption's, work force, and the cost of quality (Patching, 1999). The higher speed, the more material the company will need to produce in goods, and the more people will be needed and this can increase the cost for the company. With the cost of quality we mean the defected products that could appear when increasing the speed in relation to information, a factor, which has a decisive effect on procedure of lead-time.

Creation of trust relationships was one of the major factors that in different ways related to the concept of lead-time and was articulated during the interviews. Trust relationships between companies are important in today's environment (Cooke and Morgan 1998). This means that companies have to improve their contact with customers and suppliers in order to achieve on a 'trustful level' of relationship. As a consequence of this trust relationship, cost

of transaction can be reduced (Milgrom and Roberts, 1992). This means that instead of establishing the often expensive and sophisticated transaction mechanism, companies can conduct a more simplified and direct form of contact.

Finally, from the associations arising between these concepts, we may relate lead-time to the notion of management of time. As we interpreted, management of time is crucial for improving process management at Volvo. In another term, management of time focuses on, how well the process management helps reduce lead-time. In this context, concepts such as reducing inventories and JIT etc. are going to be regarded as part of a wider concept of management of time.

5.1.2 Less Inventory

The second theme that was drawn from the interviews is connected to the issue of inventories. Respondents related the idea of 'less inventory' as an aspect that is relevant for reducing lead-time. We asked the suppliers questions concerning in which way EDI – or EDI via Internet – would support procedures of keeping fewer inventories. The fact is that, by focusing on lead-time, companies especially in the car industry claim that they managed to have low inventory costs and reduced goods in stock (Wedel 1996).

In regard to the responses, some suppliers from both groups did not directly use the concept of JIT, simply because they were not familiar with the concept. But they often use concept of inventory for their internal and even external (selling department) inventories. JIT is an expression in theory, which they did not use in practice. Beard & Butler (2000 p.29), state that:

> "If JIT is abandoned because it does not appear to work as described in articles and textbooks, the cost savings of an efficient, integrated manufacturing process will be lost. However, the popularity of JIT inventory methods has grown steadily over the last two decades, since the appeal lies mostly in an emphasis on simplicity and a cost-saving approach."

Others related the concept JIT to the issue of less inventory and not the whole process that would lead to reducing inventories. Waters (1996 p.466) emphasises that:

> "JIT is really a simple idea, which consists of different main arguments about inventories. Those are as follows; stock is held in an organisation to cover short-term variation and uncertainty in supply and demand. JIT assumes these stocks serve no useful purpose. They only exist because poor co-ordination does not match the supply of materials to demand. As long as stocks are held, managers would not try to improve their co-ordination. This means that operations will continue to be poorly managed, with many problems hidden by the stocks. The proper thing for an organisation to do is to improve its management; find the reason why there are differences between supply and demand, and then take whatever action is needed to overcome them."

Among the suppliers that responded, there were different opinions. Some believed that JIT would not be influential at all if EDI via Internet was used, while others assumed the opposite. One respondent said that;

> "The faster it takes to deliver our components to our customers, the less goods are held in stock which in turn gives less capital tied up. We believe it is important to have good relations with our customers and suppliers to make this system work."

Waters (1996, p.468) made a comment about this, which is connected with the statement above. He stated that:

> "JIT systems organise operations so that they occur just as they are needed. It aims at eliminating waste from organisations. They do this by organising the operations so that they occur just as they are needed. This requires a new way of thinking, which solves problems rather then hides them. An important part of JIT is its emphasis on good relations with suppliers and employees. JIT realised that co-operation is more productive than conflict."

Some respondents focused on a system called Kanban when discussing JIT. This is a simple control system that is needed when using JIT. Kanban is an approach that a company can use to achieve the aim of JIT. Kanban is the Japanese word for 'card'. Kanban 'pull' materials through a process control operation. Kanban uses 'cards' to control the flow of materials for JIT operations. The supplier that uses Kanbans said that Kanban would not be influenced if EDI via Internet were used. One respondent, state that:

> "JIT would be influenced if EDI via Internet were implemented, since this would make it easier to observe and look into confirmations and orders."

From having made an analysis drawn on the theme of less inventory, we could draw two key factors that are relevant for identification of process management. These are:

- Just-In-Time
- 'Easier to follow up'

As mentioned before, to keep less goods in stock is relevant for management of time, the less goods in stock, the less capital to lock up. JIT organises all operations so they occur just at the time they are needed. Some of the key elements in the JIT system are reliable suppliers that can work closely together with their partners, short lead-times and minimum stocks.

During the interviews, the respondents emphasised that using EDI via Internet can probably make it easier to follow up orders and observe confirmations that have been made via Internet. This can be a faster way to receive and deliver e.g. 'numbers', further it will save time. Time is a valuable resource, as we interpreted management of time, it is important for improving process management at Volvo.

5.1.3 Risk

The third theme that was drawn from the interviews is connected to the issue of risk. In fact, how risky is the notion of time or speed based on management in a firm/supplier relationship. In relation to the issue of risk, questions as what kinds of risks are related to the use of EDI via Internet in comparison to EDI are emphasised. In general, respondents interpreted 'risk' as 'security'. It is easy to overlook the security issue between business partnerships when sharing data and applications with each other. Security systems that were previously used to shield corporate resources from outside invasion must now be opened, if even slightly, to let in the company's partners. One supplier states:

> "The use of EDI does not prevent the securing of the transport mechanism."

In relation to risk, having a communication system via Internet is mainly based on the security factor according to the respondents. Different kinds of aspects evolved between the suppliers when discussing security. Some of the respondents' interpreted risk from a legal perspective while others interpreted it from a transportation perspective. Group one agreed that the major risk with EDI via Internet would be security. Some suppliers thought it would be of interest to use Internet, but first the security needs to be improved even more. As one respondent in Group one stated:

> "The security factor has to be solved when using EDI via Internet."

Yasin (2000, p.31) wrote about 'EDI to the Web' in relation to security, and he expressed that:

> "To effectively move to web-based e-commerce, companies involved with multilevel transactions need high levels of security. EDI offers substantial order processing benefits. It eliminates manual operations by facilitating the electronic transfer of information between different organisations' internal applications. Its private transport network also guarantees a robust level of security."

A few respondents use EDI with X.25, they emphasised that by using X.25, it increases the security. This since 'hackers' and other skilful people are not that familiar with X.25. As a respondent states:

> "We use X.25 and we believe this gives a better level of security. This service could give companies better protection, since private persons and hackers do not usually have this program."

There is always a certain risk when using Internet; people who should not have access to certain information, could see confidential information since there is not 100% security against skilful people. On the other hand, using X.25 increases security more than not using anything at all. One supplier states:

> "There is a risk that unauthorised persons can pick up information, and in order to prevent this the car industry has more or less required X.25."

Volvo is one of the big car companies that have required X.25 net service, together with EDI. However, X.25 is expensive to buy and install and smaller companies can have problems affording this. In relation to the respondents, they think that the security should not be any different in accordance of using EDI or EDI via Internet.

From having made an analysis on the theme of risk, we can draw on two key factors that are relevant for identification of process management. They are as follows:

-Security
-Expertise

We noticed that different suppliers draw different nuance in relation to risk. Some connect risk with security, while others relate it to purchasing of goods. The security issue was the major factor that the respondents emphasised, when discussing the theme risk. We believe that, in order to solve the security

problem, companies need to hire 'experts' that can maintain a system as Internet, if the company does not already have that. Further, people can be trained and educated within the company, to achieve skills and knowledge within this area. This could be a way to get companies' staff interested and involved in using EDI via Internet. Some respondents mentioned that they had IT expertise within the company today, and they felt secure when using the Internet for other purposes.

5.1.4 Use of EDI

The fourth theme that was drawn from the interviews is connected to the issue of the use of EDI. We did ask the suppliers a number of questions emphasising this theme; how the system works today, and if the system is used in relation to lower tiers. Most of the suppliers to Volvo Car Corporation that we have interviewed have EDI as their communication/information system.

The focus on Group ones' interviews and inferences have implicated that there are different opinions among them when discussing the use of EDI towards their suppliers/customers. On one hand, some of the respondents use fax and telephone to their suppliers/customers, while others use EDI. A few suppliers use EDI towards their biggest customers, since it simplifies and speeds up the process. Volvo has required that their suppliers have to use EDI. Fredholm (1995 p.17), states that:

> "By using EDI, it improves the efficiency of ordering, billing and cutting down errors that would happen more commonly in communications by paperwork."

One supplier who uses EDI in Group one, stated:

> "We use EDI towards our biggest suppliers."

Also in Group two, there are different opinions. Some used EDI, while others received messages the traditional way; phone, letters or fax. The traditional

way of doing business takes a longer time and is not that effective as EDI or EDI via Internet can be. The respondents agreed that they only use EDI towards their customers and the traditional way towards their suppliers. Development of EDI even to smaller customers is under reconsideration, but as the situation is today, their computer system could not manage this new system.

The respondents in Group one agreed that EDI is an effective system that is simple to use and time saving. According to one respondent:

> "When using EDI you do not have to punch the numbers manually every time you make an order, which will save time and the proportion of manual defaults will decrease. Another thing that will save time is that our suppliers will receive faster handling of further plans."

Shields (2000 p.41) emphasises according to the statement that:

> "Accuracy and control of interactions with trading partners are enhanced if they use EDI. EDI also improves the information flow among all trading partners. Companies save time by not having to re-key information into computers and also by not having to fill out sacks of paperwork. Also because of the electronic payment procedure, errors and delays are significantly reduced."

Among the suppliers that responded to the question some had different opinions. In Group two some of the respondents were of the same opinion as Group one, concerning the positive effects with EDI. Others that did not use EDI today were on the other hand interested in adopting EDI, or EDI via Internet, in order to get the advantages of being more effective. By using EDI, working e.g. with numbers can reduce lead-time and this is time saving. However, this adoption would not be immediate, but sometime in the future.

We asked the suppliers a question concerning how EDI works today. According to one respondent in Group one:

> "Nowadays the EDI system is working well and we are satisfied with the system."

EDI is, in regards to those suppliers that use EDI, working well according to both groups. A disadvantage is that the system is still too expensive and complex to understand for many companies in order to be able to use it. Kay (2000 p.84), state that:

> "EDI is a difficult technology and it also requires dedicated services that are expensive. Despite such complexities, EDI is not going away anytime soon."

If companies use VANs connected with EDI, as Volvo does, then there would be no need for supervision, but as pointed out, leasing VANs is expensive. Kay (2000) also claimed that, one way to save some money is to shift the actual data transport from more costly private networks to Internet. One of the suppliers in Group two expressed that they are going to implement EDI towards their suppliers the coming month, and not only use the system towards their customers. One respondent stated:

> "EDI simplifies work for employees that are working with the system, it can also deliver plans more often and take care of the needs at once."

In regards to the statement above, Kay (2000 p. 84) states that:

> "EDI provides more timely information for making decisions, more transactions can be completed without increasing the staff. Computers must be able to communicate directly between each other, which EDI system does so it could take care of the needs immediately."

From having made an analysis on the theme of the use of EDI, we can draw on two key factors that are relevant for identification of process management. These are:

- Efficiency
- Time saving

In regards to efficiency, it is one of the major factors for companies' survival. Companies that have not implemented EDI, use the traditional way, letters or fax etc., to communicate with suppliers and customers. This is less effective and more time consuming. We believe that, to install EDI or EDI via Internet would be a more efficient way to communicate with suppliers and customers in the long run. As mentioned before, EDI is an expensive system and one alternative would be to adopt EDI via Internet, since this could be less expensive.

As mentioned before EDI via Internet can be time saving, compared to EDI or the traditional method for communication. It is relevant to consider time, if companies want to stay competitive in the market. We believe that, using e-mail to conduct business between two parties is less time-consuming and saves money, it is more or less comparable to face-to-face contact. Further, as predicted by (Porter 1986) to be at a competitive edge, companies have to achieve more capability in delivery on the JIT basis. Companies that have EDI do not have to type in e.g. numbers manually, which is timesaving.

5.1.5 Change in information technology

The fifth theme that was drawn from the interviews is connected to the issue of change in information technology. We asked the suppliers a number of questions emphasising this theme, questions concerning EDI via Internet; what kind of effects can occur and is there any interest today to move towards EDI via Internet. Internet has become more rapidly developed during the years, more and more companies are using Internet within their business. As mentioned before, almost all respondents have EDI as their communication system, when transferring information between companies. Some big companies as Volvo are trying to take advantage of using EDI via Internet in order to reach out to more suppliers. This could also be a way to attract smaller

suppliers that cannot afford to implement an EDI system since it is expensive to lease VANs.

The answers, according to Group one, to what effects can appear if EDI via Internet was used, are different within the group. Some argued that there would not be any difference when using either of the systems. One respondent mentioned that they are working to create a portal for smaller suppliers that cannot afford to invest in the EDI system. They could provide them with delivery plans and also notify them when their goods are ready to be delivered through their web site on Internet. Furukawa (2000 p. 6) mentions that:

> "Internet is simply conducting commerce electronically and the new infrastructure is intended to join all the large and small companies via the industry's central EDI web site. This makes it possible for all manufacturers, traders, distributors, processors and users to share a common database. The purpose of the new EDI network using the Internet is to involve those smaller companies in sharing information so that the entire industry can function efficiently."

Suppliers in both groups emphasised cost reduction as an advantage if EDI via Internet can be used. Thus, using EDI via Internet can be an alternative for reducing the cost, since for example installing a X.25 net service is too expensive. Kay (2000 p. 6) states that:

> "EDI is, as mentioned before, a complex and expensive system. Instead you can move towards Internet and use XML, since it is cheaper to operate and support. XML presents data in human-readable format, this makes it easier to train and keep programmers. Companies can also run XML applications on inexpensive Web servers over existing Internet connections. This is a way to automate its global, supply chain process to let customers use the Web to transmit purchase orders, shipping notices and invoices quickly and easily to the company."

In regards to the answers delivered by the respondents concerning the interest to implement EDI via Internet, there are several suppliers that are interested in using EDI via Internet, since this would give them advantages as; faster speed and make it easier to communicate with their customers. Shields (2000 p. 41) states that:

> "Using Internet would add more capabilities and flexibility for companies that wish to engage in electronic business information exchanges."

One respondent states that:

> "We want to reach out to as many companies as possible, the speed of the transfer of information is important to us. We are hoping that using EDI via Internet will make a few improvements."

Among the suppliers in Group two that responded to the question some had different opinions. Some respondents were not that enthusiastic for the moment as group one to use EDI via Internet. They rather take one step at the time, and continue to develop EDI within their business. Although they are not afraid to start using it in the future, since, e.g. the technology is constantly changing and improving and they did not want to be 'left behind'. Others were not aware of how EDI via Internet would work, since they were not very familiar with Internet, and avoided answering this question. One supplier stated that:

> "We are for the moment concentrating on implementing Odette, which we are going to use in the beginning of next year. Using Internet could be interesting for us in the future but right now we are concentrating on improving the system that we are working with for the moment."

According to the question of how the relations between suppliers and customers can be affected by using EDI via Internet, there were different opinions within the group. Some suppliers said that it would not be a cost for

their suppliers to use EDI via Internet, since leasing VANs is more expensive. Others were not sure how it would affect the relation, but they were hoping that it would improve their customer relations for the better. Suppliers in Group two also had different opinions within the group. Some mentioned that the relations would not be influenced at all; others responded that they did not know, while others assumed that the speed of exchange of information would be faster. One supplier in Group one states that:

> "Our relations with our customers will be positively influenced if EDI via Internet is used, since the flows would improve and be faster when transferring data between our suppliers and us."

From having made an analysis drawn on the theme of the change of information technology, we can draw one key factor that is relevant for identification of process management. This is as follows:

- Positive effects of using EDI via Internet

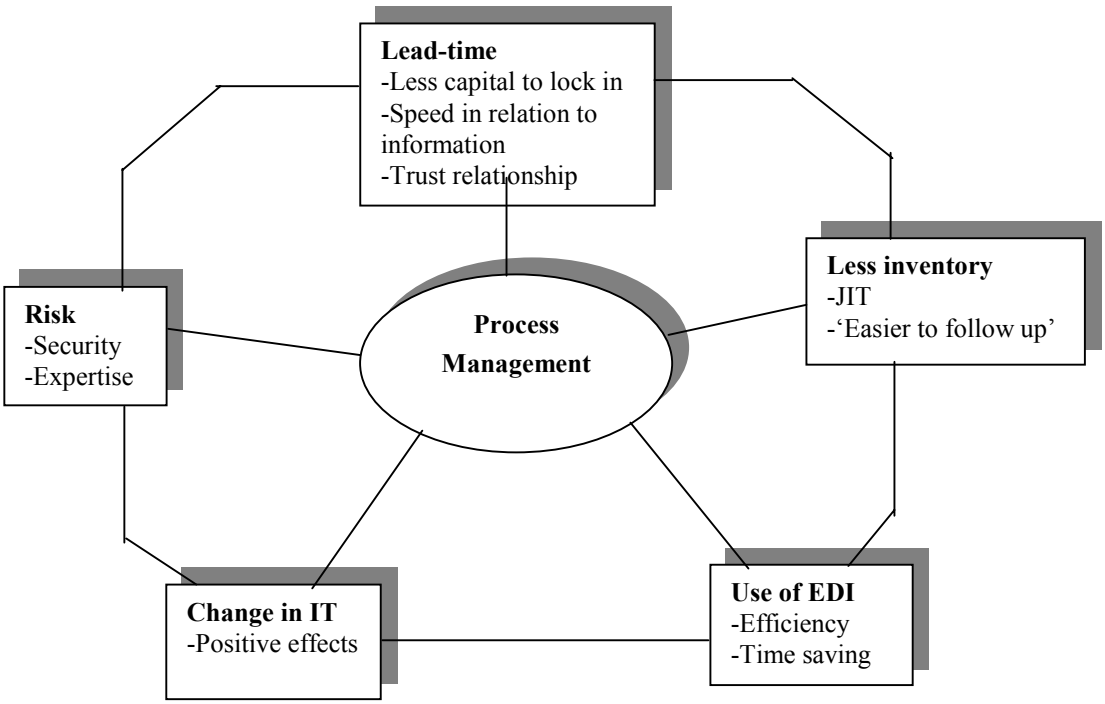
Most of the respondents were positive to changes and new technology, although for the time being, they wanted to improve the system they have. Some suppliers stated that unless Volvo required that their suppliers used EDI via Internet, they would not start using it any time soon. But they were not unfriendly to the idea of implementing it in the future.

Most of the suppliers in group one assumed that lead time would be reduced, and that the process can be more effective, if they can work with EDI via Internet. They also thought that messages could be easier to interpret. Group two on the other hand, was a bit more sceptical. Some thought that there would not really be any difference from the customised EDI, while others were more optimistic.

5.2 Components of process management

In our analysis we try to characterise, in more detail, what we mean with the concept of process management. First, we see this concept as a feature of a proactive management approach. This means, using features of associational relationship when creating the processes needed in order to communicate. Second, we also see this concept in terms of assigning network as a mechanism to increase the associational relationship. With associational relationship we mean, to know about common views on state of affairs. On the contrary, we separate activities that led to a creation of networks for communication, from activities that use this communication to trade. We identify this possible process management by presenting the following model.

Figure 5.1 A suggested illustration for a possible process management



The illustration above shows a restructured process management, based on the answers delivered by respondents and ideas drawn from information and material from Volvo.

We identify process management in two aspects. The first one is related to the notion of structure that can shape this process management. The structures are illustrated and presented in terms of several interrelated concepts, which are relevant in the context for both Volvo and their suppliers. The other aspect is related to the notion that gives meaning to a structure that has shaped this process management. In the first section we discussed, in detail, how these concepts are used by respondents, and what they emphasised for each concept.

We present process management in an interactive view. With interactive view we mean, that we take Volvos' and their supplier's perspective together, in order for them to interact, in communication via EDI and in the future EDI via Internet.

We believe that the concept of trust is the most important factor to consider since all concepts in process management are dependent on each other, and trust is the key-concept to connect and make the 'system' work. Trust, which is specified in model 5.1, is essential and we are going to evolve it further. Trust is deeply related to the concept of expertise and system. To rely on someone, who has skill and expertise, can reduce the uncertainty for people that are not familiar with the risk related to the outcome. As we understood according to Luhman (1979), individuals trust systems and experts more now than before.

We believe that, in order for process management to work, it must be organised in such a way where people working within the organisation feel that it is a secure organisation where employees can rely on each other, and that both systems; EDI and EDI via Internet, must be adapted to the context of the parties who are involved in the process. Further the expertise that is involved in shaping this process management must be acquainted with the internal work and activities, which are taking place between Volvo and its suppliers.

Concept of trust can even be related to customers. A network between customers and suppliers is a matter of trust. Involvement of system and expertise must not just support, for example, reduce Volvos inventories, it must also support the suppliers in order to minimise their stock of parts. One

basic effect of a communicative system that creates a trust relationship is that, it can reduce the transaction costs. In an interactive system, cost reduction is an important achievement. Another aspect of such a communicative-based trust relationship is that Volvo can support its product development (Gopalakrishnan, 1999). However, the establishment of such a system may have a beneficial effect for Volvo, for example in order to get in touch with new suppliers and to reduce price for parts that they need in their manufacturing.

Another advantage when establishing this system is that, it provides the possibility for an exchange of, contextual and timely information without being distorted by intermediaries.

One other relationship that is coupled with trust is the technical capability with the system. As it is depicted in the illustration, security of the system and the role of expertise in giving such security are essential. There is a link between communication where trust is involved and co-operation. Due to the Internet the future co-operation between companies and suppliers can be affected by an easier way of communicating to different tiers.

According to Cooke and Morgan (1998 p.30), the above-mentioned points have a theoretical meaning:

> "Trust-based relationships are said to confer at least three major benefits on participants who have taken the time and trouble to develop these relational assets: first, they are able to economise on time and effort because it is extremely efficient to be able to rely on the word of one's part, secondly, trust reduces risk, and finally they have greater capacity for learning because they are to thicker and richer information flows. To be effective a trust-based relationship requires rich structures, which allows participants to monitor their interactions."

In the previous chapter we analysed the answers that we received from our interviews, and came up with an illustrated model based on the suppliers answers. In this chapter we are going to sum up and point out relevant concepts in order to achieve a well functioning process management.

6 Results and conclusions

In order to be able to carry out our study, we made contact with Volvo and studied literature relevant for process management and electronic network. We addressed our questions by consideration of process of lead-time reduction at Volvo. We found out that, concept of process management is relevant to structure our framework. Finally, we developed a framework for studying process management, as a specific theme for Volvo.

In this chapter we sum up what has been discussed so far. We also draw conclusions a little bit more conclusive of what we mean with concept of process management. Thus, our study is grounded on information received from Volvo, suppliers but also theoretical literature on the subject. We have constructed our own framework to continue the study.

In chapter one, we exhibit a model that depicts a number of interrelated concepts. By process of our study we have expanded this model and re-designed its structure (see figure 5.1). The re-designation of the model was carried out on the notion of five concepts. These concepts; lead-time, risk, less inventory, information technology and use of EDI, are the concepts that suppliers emphasized mostly on. The most important results that we have drawn out from the study are as follows.

A. Most suppliers were interested in improving their communication system by electronic network exchange. A few suppliers would implement the system in the future but they were satisfied with the system that they were using for the time being. Suppliers common view is that, reduction in lead-time will reduce bounded capital. Companies will have less good in stock, which means that less capital is locked up and this will lead to a reduction of cost in capital. However, the speed of exchange of information would be faster but it may increase the cost, in terms of raw material consumption's, work force etc.

B. A trustful relationship between companies and its suppliers is an important element when establishing process management. It is essential to achieve a 'trustful level' of relationship, since it will e.g. reduce the uncertainty for people that are not familiar with the risk or security related to the outcome. We believe that in order to have a process management that would work, it must be organized in a trustful manner where EDI and EDI via Internet must be adopted in the context of both parties.

C. The traditional way of doing business takes longer time and is not as effective as EDI or EDI via Internet would be. Today EDI is expensive to buy and implement, but on the other hand it is a simple system to use and time saving. In order to get the advantage of being more effective, e.g. working with numbers can reduce lead-time and this is time saving, the suppliers are aiming at adopting EDI via Internet in the future.

D. Since EDI via Internet is not implemented yet, the suppliers found it difficult to predict how and in what way unexpected factors would affect the communicative process. But they were positive to changes and new technology and have some comments about what would happen and emerge. Some suppliers said that EDI via Internet can reduce lead-time and that the process can be more effective, although it would not lead to competitive advantages. They also believed that messages could be easier to interpret. The disadvantage implementing this system would be

that the security would probably not be as good in the beginning as with the traditional EDI. By using EDI via Internet it would almost certainly make it easier to follow up orders and observe confirmations that have been made via Internet. As mentioned before it is always difficult to predict, what the outcome of a system that is in the initial phase, would look like.

6.1 Conclusive remarks

We have addressed our questions in relation to reducing lead-time within Volvo. We have made interviews that made us familiar with different themes and ideas related to reduction of lead-time and use of networks. We have discussed ideas, which we assumed were relevant for understanding process management. It was interesting to see during the interviews, how the suppliers interpreted the concepts in different ways. Four themes, can be considered, which we believe are relevant for establishing a workable process management.

1. Firstly, process management must be seen as a proactive management approach. That is, management experts and other participants, constantly involve their attempts to maintain and develop the process on the basis of their internal information.

2. Trust is an overall element in the conducting of the whole process.

3. Instrumental communication (Internet) of any kind should be complete with the participants' interaction and their need for communication.

4. Communication based on EDI or EDI via Internet should provide possibilities for easy exchange of information, and also that the participants can easily decode the information.

From the traditional way of doing business, e.g. telephone and fax, EDI had a positive effect in relation to efficiency and time saving. Processes in relation to EDI could be speeded up and it also became much more secure. By using EDI companies do not have to type in e.g. numbers manually which is time saving.

We believe that to install EDI or EDI via Internet would be a more efficient way to communicate with suppliers and customers in the long run.

We realized that, Volvo is in the initial phase to implement EDI via Internet. Managers in Volvo knew that EDI via Internet is less expensive than the traditional EDI system. We believe that this can be more cost effective; some suppliers, which are smaller in size, can afford these expenses and implement EDI via Internet. There are a number of negative factors involved in adoption of an electronic network exchange. Risk seems to be a factor to consider when using Internet, since firewalls that were previously used to shield corporate resources from outside innovation must now be opened, to let in companies partners.

Time is a valuable resource and we believe it is important for improving process management in Volvo. It is relevant to consider time; we conclude that speed in relation to information is a key factor if companies want to stay in a competitive environment. Using Internet to conduct businesses between parties is less time consuming and saves money than face-to-face contact.

To have a secure and trustful relationship when implementing a new system is essential for companies. In order to solve the security issue we believe that companies need to hire 'experts' that can maintain a system as Internet, if companies not already have that. People can also be trained or educated within the company to achieve special skills and knowledge within this area. To have a trust relationship is an important factor that has to be considered in a workable process management. We believe process management must be organized in such a way, where people working within the organization feel that it is a secure company and trust is a main factor, that employee can rely on each other and work closely together with their partners. Concept of trust can even be related to customers and suppliers, in a communicative system with a trustful level it can reduce e.g. lead-time.

Suggestions for further research

To create a virtual marketplace with On Line Quoting (OLQ) and catalogue buying is interesting to focus on. It can be draw from both discussions with Volvo, Volvo documents, and interviews with suppliers, that this is a new and interesting area. This kind of virtual market place has been used very rarely, but one area where catalogue buying has been tried is on office material, e.g. paper in which several dealers participated. Another interesting aspect is how Volvos participation in a Ford defined system view can result in a unified networking model.

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Appendix I

Questionnaire about EDI and EDI via Internet

1. Which communication system, EDI or EDI via Internet, does your company use towards its customers?

2. Is this communication system used towards your suppliers? If the answer is yes, how does this affect your company?

3. How does your communication system function today? In what way does the system you use facilitate your work?

4. If EDI via the Internet was implemented at your company, which effects could appear in comparison with the traditional EDI system?

5. Is there any interest within your company for EDI via Internet to be used as your communication system? Does your company have experts who can maintain a system such as Internet?

6. In what way can EDI via Internet affect the relation between your company and its suppliers and customers?

7. What kinds of risks can be related with using EDI via Internet compared to the traditional EDI?

8. Can the speed and flexibility be affected if EDI via Internet is used?

9. Can the Just-In-Time be affected if EDI via Internet was used?

10. In what way can the relation between your company and your companies' suppliers be affected, if EDI via Internet was implemented, and not just between your company and your customers? What positive and negative effects could arise?

11. Could the lead-time be affected if EDI via Internet was used as a communication system?

12. Could your company's sales be affected if your lead-time was reduced?

13. If the lead-time was reduced, could this lead to competitive advantages for your company? If the answer is yes, in what way?

Appendix II

Frågeformulär angående EDI och EDI via Internet

1. Vilket system, EDI eller EDI via Internet använder ni som kommunikationssystem?

2. Använder ni EDI via Internet till era leverantörskontakter? Om svaret är ja, hur påverkas ert företag av detta?

3. Hur fungerar ert kommunikations system, EDI eller EDI via Internet, idag? På vilket sätt kan systemet underlätta ert arbete?

4. Om EDI via Internet implimenterades på ert företag idag, vilka effekter (positiva/negativa) skulle kunna uppstår i jämförelse med det traditionella EDI systemet?

5. Finns det intresse hos ert företag att EDI via Internet används som kommunikationssystem? Har ni kunskap om Internet, samt tillgång till experter som kan att driva och underhålla ett system som Internet i dagsläget?

6. Kan Internet kommunikationen påverka förhållandet mellan er och era kunder/leverantörer?

7. Vilka risker innebär det att använda EDI via Internet i jämförelse med det traditionella EDI?

8. Kan hastigheten/flexibiliteten på transaktioner påverkas om EDI via Internet används som kommunikationssystem?

9. På vilket sätt kan Just-In-Time systemet påverkas om EDI via Internet används istället för det traditionella EDI systemet?

10. På vilket sätt påverkas relationen mellan er och era leverantörer/kunder om EDI via Internet används. Vilka positiva och negativa effekter uppkommer?

11. Kan ledtiden påverkas om EDI via Internet används som kommunikationssystem?

12. Kan er försäljning påverkas om ledtiden reduceras?

13. Om ledtiden reduceras då Internet används kommer detta bidra till konkurrensfördelar för er? I så fall vilka?