INTERNATIONELLA HANDELSHÖGSKOLAN
HÖGSKOLAN I JÖNKÖPING

Inverkan av en realtids IT-logistiklösning

Implementationseffekter och konsekvenser

Filosofie magisteruppsats inom informatik

Författare: Daniel Abdiu
Mikael Strandberg
Martin Stridsberg

Handledare: Ulf Seigerroth

Jönköping juni 2005

JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
Jönköping University

The impact of a real-time IT-Logistics solution

Implementation effects and consequences

Master's thesis within informatics

Author: Daniel Abdiu
Mikael Strandberg
Martin Stridsberg

Tutor: Ulf Seigerroth

Jönköping June 2005

Magisteruppsats inom informatik

Titel:	**Inverkan av en realtids IT-logistiklösning**
Författare:	**Daniel Abdiu, Mikael Strandberg, Martin Stridsberg**
Handledare:	**Ulf Seigerroth**
Datum:	**2005-06-14**
Ämnesord	**Flödeshantering, Vendor Managed Inventory (VMI), Realtidslösningar, IT-Logistik lösningar, Affärsförändring**

Sammanfattning

Konkurrensen är stor inom dagens affärsmarknad vilket medför att företag ständigt måste vara uppdaterade och förändra deras affärsverksamhet för att kunna överleva och vara konkurrenskraftiga på marknaden. Dagens marknadssituation erfodrar att företag snabbt kan reagera på marknadsförändringar och nya kundkrav vid allt kortare produktlivscyklar. För att företag skall kunna hantera denna nya marknadssituation måste företagen bli integrerade med varandra inom deras affärsområde. Denna integrering underlättar företagens förmåga att snabbt kunna anpassa sig till nya marknadssituationer och överleva på en snabbt föränderlig marknad.

Ett utav de största grundläggande koncepten för denna integrering är flödeshantering (Supply Chain Management). Flödeshanteringen integrerar och koordinerar företagets processer både internt som externt. Informationsteknologi (IT) kan förbättra effektiviteten av flödeshanteringen. IT-lösningar skapar effektivare affärsprocesser och förbättrar integrationen med andra aktörer inom företagets försörjningskedja.

Syftet med uppsatsen är att beskriva och förklara effekter för affärsverksamheten samt konsekvenser för dess affärsprocesser, vid en implementering av en realtidslogistiklösning. Uppsatsen syftar vidare till att identifiera framgångsfaktorer vid en sådan implementering.

Uppsatsarbetet har genomförts genom en litteraturstudie där teori om flödeshantering, affärsförändring och implementationseffekter har behandlats. En fallstudie i uppsatsen har använts där tre aktörer har blivit intervjuade; en tillverkare (Volvo Powertrain), en underleverantör (Metallfabriken Ljunghäll) och en systemutvecklare (PipeChain).

Analysen av litteraturstudien och den empiriska undersökningen har bidragit till en identifiering av huvudeffekter samt konsekvenser vid en implementering av en IT-logistiklösning. Några av dessa effekter är: lagerreducering, högre leveranssäkerhet, förbättrade relationer samt ökad flexibilitet. Exempel på konsekvenser dessa effekter har orsakat är: precisare planering och produktion, effektivare produktionsprocesser samt förbättrad leveransprocess. Vidare så har framgångsfaktorer för lyckad implementering identifierats så som ömsesidig tillit, förståelse för förändring samt utvärdering.

Master's Thesis in Informatics

Title:	**The impact of a real-time IT-Logistics solution**
Author:	**Daniel Abdiu, Mikael Strandberg, Martin Stridsberg**
Tutor:	**Ulf Seigerroth**
Date:	**2005-06-14**
Subject terms:	**Supply Chain Management (SCM), Vendor Managed Inventory (VMI), Real-time solutions, IT-Logistics solutions, Business renewal**

Abstract

Today's business market is highly competitive, therefore companies need to be constantly updated and change the way they operate their business, in order to survive and remain competitive. The situation on today's market requires that companies have the ability to quickly respond to market changes and new customer demands within short product lifecycles. In order to deal with this new market situation, companies need to improve the integration with other companies within their business. This integration facilitates the companies' ability to quickly adapt to new market situations and survive on a fast changing market.

One of the main underlying concepts of this collaborative commerce is Supply Chain Management (SCM) which integrates and coordinates a company's processes both internally and externally. Information Technology (IT) could improve the effectiveness of SCM. IT-solutions make the business processes more effective and improves the integration with other actors within the supply chain.

The purpose with this thesis is to describe and explain the effects for businesses and the consequences for its processes when implementing a real-time IT-Logistics solution together with identifying the critical success factors.

The thesis has been conducted by studying theory regarding supply chain management, business renewal and implementation effects. Further, a case study has been conducted where three actors have been interviewed; a manufacturer (Volvo Powertrain), a subcontractor (Metallfabriken Ljunghäll AB) and a system developer (PipeChain).

The analysis of the theoretical framework and the empirical research has contributed with an identification of major effects and consequences when implementing a real-time IT-Logistics solution. Some of the effects are: inventory reduction, higher delivery accuracy, improved relations and increased flexibility. Examples of consequences these effects have caused are: more accurate planning and production, effective production processes as well as an improved delivery process. Additionally, success factors for an implementation have been identified such as mutual trust, understanding of change and evaluation.

Table of contents

Figures

Tables

Appendices

1 Introduction

This chapter will give the background to the topic of interest which will continue through a problem discussion, where the different problems associated with the implementation of supply chain technologies will be presented. This discussion will end by clarifying the purpose of the thesis. The delimitation of the thesis is then explained followed by the knowledge contribution. Some definitions are given to clarify the essential terms used throughout this paper. This introductory chapter ends with a clarification of the report's disposition in order to facilitate further readings.

1.1 Background

The difficulties for a company today are to quickly respond to the market and at the same time satisfy customers' needs within short product lifecycles (Wu, Chiag, Wu, & Tu, 2004). Today's market situation requires more from companies since it is not enough to simply produce high quality products. Companies today need to fulfill the customers' needs at often low prices, followed by an efficient delivery (Wu et al., 2004). This new situation has caused changes for companies' business processes. New technology and adaptability have been two important factors that a company needs to deal with in order to be competitive and survive in a fast changing market (Wu et al., 2004).

The interdependencies between organizations are becoming closer because of shrinked market margins, time-based competition, low-inventory levels and limited facilities capacities in the supply chain network (Li, Kumar & Lim, 2002). To deal with this new market situation, companies need to improve the integration with other actors within their business. An effective integration improves the coordination of activities through information exchange as well as the ability to quickly adapt to new market situations. One of the main underlying concepts of this collaborative commerce is Supply Chain Management (SCM) which gives a competitive advantage for the companies involved (Ruppel, 2004). SCM is an integrated philosophy with the main objective of improving overall efficiency and effectiveness in the entire "*pipeline*", from supply of raw materials to production, distribution and then ultimately to the end customer (Helo & Szekely, 2005).

An efficient way to improve the effectiveness of SCM is to use Information Technology (IT). IT-solutions improve the integration with other actors in the supply chain and make the business processes more effective. This is done by reorganizing the processes and automating the information-flow between the businesses involved (Wu et al., 2004). Information technology has developed in a very fast pace in the area of supply chain management. This has generated new tools and solutions to handle the information sharing between different actors in supply networks. These types of supply chain technologies are of great current interest which is indicated by a research made by AMR Research Inc. The research indicates that nearly $15 billion been spent on SCM software since 1999 in the US alone (Ruppel, 2004). One third of the companies spend more than $10 million annually on supply chain initiatives with 90 percent planning additional investments in 2004 (Ruppel, 2004). The market for global supply chain management software is growing at about 40 percent per year (AMR, 2004).

According to Helo and Szekely (2005), the typical goals for SCM are to increase the productivity through reduction of total inventory and the cycle time for orders. In order to fulfill these objectives, the company needs to optimize the business processes related to material handling, information processing and capital control in relation to its limited resources (Helo & Szekely, 2005).

According to Boughton and Kehoe (2001) the key to improved supply chain operations is not entirely based on efficient information transfer but also on timely information availability.

Companies are in a position today that enables them to anticipate demand fluctuations and respond accordingly (Boughton & Kehoe, 2001). Internet enabled applications make it possible to view supply and demand information through the entire supply chain. The need for real-time information will become crucial which will put an emphasis on flexible IT-solutions that can process large amounts of data which easily can be linked with other systems (Helo & Szekely, 2005).

There is clearly a development towards real-time IT-Logistics solutions that provides timely information on customer demand. The use of real-time solutions compared to non-real time solutions would mean inventory levels approaching to zero and as an effect of that reduce the lead times together with attaining a higher customer integration. This will of course have substantial impacts on the organization in order to align the real-time solution with the processes of the business and with other actors in the network.

1.2 Problem discussion

Real-time demand from the customers gives opportunities for optimizing the entire flow from the producer to the end consumer. However, this requires the use of information exchange and IT-support for achieving effective logistics. Information exchange is considered a key factor for successful supply chain management (Moberg, Cutler, Gross & Speh, 2002). This creates difficulties because within the field of information exchange, little previous research has been conducted related to supply chains (Moberg et al., 2002).

According to the Gartner Group (2001), by 2004, supply chain networks would become a general accepted alternative for in-house management of supply chain information. The SCM Application Spending Report 2002–2004 by AMR Research reports that 54 percent of the companies surveyed are without SCM software today, of which 20 percent plan to implement it within the next year (AMR, 2004). By 2004, 90 percent of enterprises that fail to apply networked SCM solutions would lose their status as prefered suppliers (Gartner Group, 2001).

These numbers show that IT has become a major differentiator and plays a vital role to obtain an effective and efficient organization. IT-solutions affect the business to a great degree and can be seen as a major change medium for organizations' processes (Chan, 2000). Therefore, it is of great importance to consider this and observe the effects and related consequences when implementing an IT-Logistics solution. An implementation of an IT-solution brings several effects for the business. These effects lead to consequences for the business processes which can result in changes in different roles and responsibilities. We have discussed these aspects, which in the end has led us to several research questions which we believe is interesting and important to conduct further research within, these are:

What are the effects for the business by implementing a real-time IT-Logistics solution?

The effects concern the business and the results after an implementation. These effects need to be identified and highlighted so the companies implementing a real-time IT-Logistics solution know what to expect. The implementation effects are related to the consequences on the business processes.

What are the consequences for the business by implementing a real-time IT-Logistics solution?

Because of the growth and high investments in SCM software, it becomes extremely important to look at the effects of such investments on the business and evaluate the consequences for its processes. However, as much as 86 percent of supply chain professionals believe that the current supply chain techniques do not meet the actual needs in the market with 53 percent not satisfied with the return on investment (Ruppel, 2004). This indicates that competitive advantage is gained, not solely by obtaining supply chain technologies, but also through effective implementation of these techniques since they have a substantial impact on the processes of the business (Ruppel, 2004).

An understanding of change is an underlying factor for success when dealing with implementation of supply chain software (Ruppel, 2004). Because supply chain technology still have a great potential for growth it is important to consider what kind of factors that has an impact on the correspondence with the users' business needs (Ruppel, 2004).

It is vital to consider the consequences for the business processes of implementing a real-time IT-Logistics solution and not just the effects of such an investment. The effects are more evident and easier to understand and deal with, such as stock reductions, but what about the consequences caused by Business to Business (B2B) process alignment?

As given by the preceding discussion, to embrace the possibilities with a supply chain solution that links B2B processes together means not just focusing on the technological issues. Rather it is a combination of technology and business renewal which affects the entire way of doing business. To be successful with implementing a supply chain technology requires a redesign of existing processes. The redesign might create new processes and removing the ones that become obsolete.

How do different roles and responsibilities (process owners) change in order to reflect the new concept that the new technology brings?

An evaluation of the change in roles and responsibilities generated by an implementation of a real-time IT-Logistics solution will not be considered because of research limitation in time and scope. It is definitely an interesting area to perform further research within but since it involves another aspect, it could be seen as standalone research.

What critical success factors need to be present in order to perform a successful implementation of a real-time IT-Logistics solution?

It is essential to evaluate the impact the new technology will have on the business and the consequences this will have on its processes, both internally and externally. With this understanding it is possible to define the critical success factors that must be evident and managed in order to carry out a successful implementation of a real-time IT-Logistic solution.

Do differences exist in the perceived effects of implementation for different types of businesses?

Looking at differences in implementation-effects for different types of businesses is the next step for reaching a higher degree of generalization. However, this is too comprehensive for the scope of this thesis and will be set aside for future research.

1.2.1 Selected Problem statements

The thesis will focus on the following problem statements which will guide the entire research.

- What are the effects for the business by implementing a real-time IT-Logistics solution?
- What are the consequences for the business processes by implementing a real-time IT-Logistics solution?
- What critical success factors need to be present in order to perform a successful implementation of a real-time IT-Logistics solution?

These three research questions have been chosen because they constitutes the foundation of the issues that has been considered in the problem discussion. The other two questions which have been discussed in the problem discussion require deeper knowledge in order to be answered and can therefore be stated as further research questions.

For that reason, the scope of this thesis will cover the effects and consequences for the business through implementation of a real-time IT-Logistics solution. Related to the business effects and consequences are to identify the critical success factors (CSF's) that must exist in order to carry out a successful implementation of such solutions.

1.3 Purpose

The purpose of this thesis is to describe and explain the effects for businesses and the consequences for its processes when implementing a real-time IT-Logistics solution together with identifying the critical success factors.

1.4 Delimitation

This report will not consider modification of already existing solutions, only the implementation of new real-time solutions due to more distinct effects and consequences before and after an implementation. By focusing on implementation of new solutions a higher degree of generalization can be reached. Compared to modification of existing ones where change and impact may be different depending on the existing solutions. Real-time solutions will be the focus since this is where the challenge lies in the near future. Further, the extension to connect to other businesses will be in focus, not just real-time solutions for one actor in the supply network. Related to this area of investigation is to find the critical success factors for carrying out an implementation of a real-time IT-Logistics solution.

1.5 Knowledge contribution

The knowledge that will be contributed is an understanding of the impact on the organization when implementing a new real-time solution. Therefore, the type of knowledge is mainly of descriptive- and explaining nature.

The focus will be to identify the consequences this implementation will have on the existing business processes for the individual business as well as for the supply network.

The knowledge provided aims at describing and explaining the effects and which processes gets affected as a cause of these effects that the real-time solution brings.

Because implementation of a real-time IT-Logistics solution requires intense collaboration, it is of great value to explain the alignment of processes between the actors involved.

Based on the above understanding, it will be possible to identify and clarify the factors that need to be present for a successful implementation of a real-time IT-Logistics solution.

1.6 Stakeholders

The knowledge that this thesis provides is directed towards corporations involved in collaboration with customers/suppliers and are planning or currently implementing a real-time IT-Logistics solution. Other stakeholders that may come in contact with the thesis in academically situations are researchers, tutors as well as other students.

1.7 Definitions

This thesis uses many technical terms and concepts that could be difficult to understand. We have therefore created a list of definitions so the reader could get an understanding of some of them. We have selected three main definitions that are vital to understand for the purpose of this thesis. The rest of the terms used throughout the thesis will be clarified and explained in appendix 1 and is presented in alphabetical order.

Effects:

An effect could be seen as a result of something. In this case it is the result of an implementation of a real-time IT-Logistics solution regarding the business. Such effects could for example be reduced administrative work. An effect often causes different consequences.

Consequences:

A consequence is based on an effect and affects the way of working. We would like to see what consequences that have been generated due to the effects of an implementation of a real-time IT-Logistics solution and how that have affected the processes for a business. An example of a consequence could be that the order-handling process needs to be changed due to an effect of less administrative work.

Critical Success Factors

With success factors in this thesis we refer to factors that must be attained in order to carry out an successful implementation of a real-time IT-Logistic solution. The factors that have a major impact on the result of an implementation have been classified as critical success factors.

1.8 Disposition

The overall approach of the research can be summarized in the following model which will form the basis for the structure of the thesis. We created this model to visualize the work and disposition of the thesis. We believe this will contribute with a better planning of the thesis and to easier see our own milestones as well as the content of the thesis and its goals.

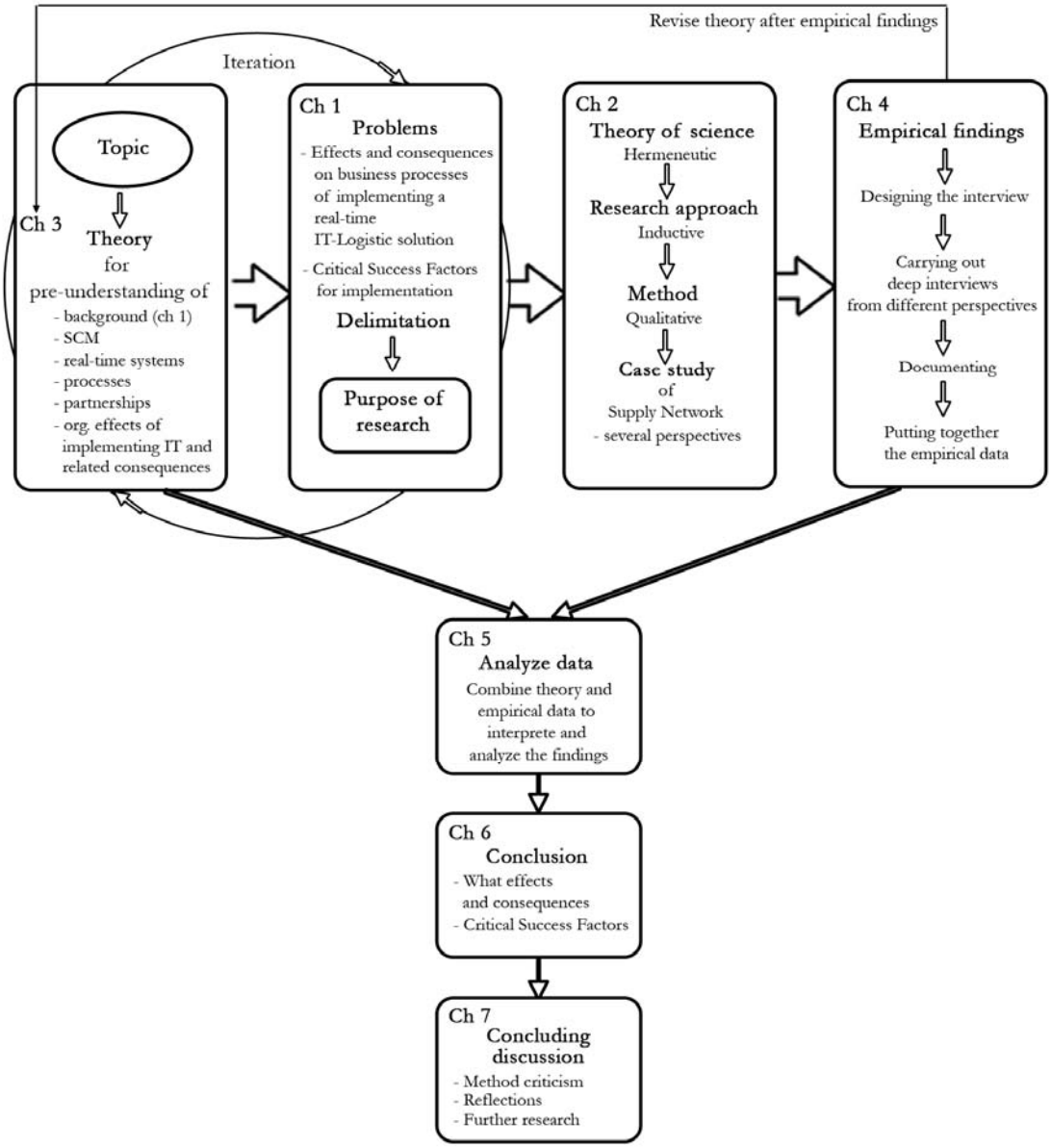

Figure 1.1 Overall approach

2 Method

The choice of the research method is the underlying foundation for how to conduct the entire research. In this chapter a discussion regarding the theory of science, research approach and choice of method will be held. Later on the techniques for gathering information and how the selection was determined will be presented. The trustworthiness of the research regarding validity and reliability is also discussed in this chapter.

2.1 Theory of science

The intention of this research is to describe and explain the effects for the business and the consequences for the business processes of implementing a real-time IT-logistics solution. To be able to accomplish this, it is salient to have a well structured research method which is based on the purpose of the research. A deeper understanding is required in order to obtain valuable knowledge due to the complexity of the research. A yes or no question, as in the case of hypothesis testing, may not be sufficient or not even possible in this situation. There are so many factors that must be taken into consideration, therefore, an analysis and interpretation of each case is vital to attain a generalized conclusion. This is in line with the hermeneutic science, which has interpretation and comprehension as its main approach (Lundahl & Skärvad, 1999).

The other main philosophy that exists in the theory of science is positivism. Positivism is according to Guneriussen (1997) the science were all theories and concepts should be built on one-sided and completely reliable observations. Deductive hypothesis testing is mainly the basis for positivism (Molander, 2003).

Lundahl and Skärvad (1999) states that positivism constitutes the underlying philosophy for a quantitative research approach whereas hermeneutic is the philosophy behind a qualitative approach. Because of the relative complexity of our area of investigation and the fact that all respondents involved are different in terms of peoples' perceptions of the effects and consequences, it is not feasible to adopt a positivistic approach. Thus, it is hard to draw a line between facts and perceptions which are required in the positivistic science (Lundahl & Skärvad, 1999). Another aspect of the complexity regarding IS research is the problem to measure the change and effects IT has on the organization. The trend in IS research is therefore moving towards a non-positivistic research approach to be able to measure and understand the impact of IT (Avgerou, 2000). However, one of the main advantages with the positivistic philosophy is that high reliability can be achieved which makes it possible to repeat the study with the same result (Lundahl & Skärvad, 1999). Though, this may not be possible in our research due to situational dependence and environmental aspects such as changes in peoples perceptions as well as the time factor involved.

A hermeneutic approach is more suitable for this thesis, where a pre-understanding of the whole is required in order to interpret the different parts and analyze underlying patterns to come up with a generalized conclusion. This is referred to as the "*hermeneutic circle*" (Molander, 2003; Repstad, 1999). This thesis requires a pre-understanding of the whole supply chain and its network and related theories to interpret the parts linked in the supply network such as the subcontractors view. Further, the aim is to find patterns between these parts to come up with a generalized conclusion, regarding effects for the business, consequences for its processes together with identifying the critical success factors of an implementation.

Criticism which is often discussed regarding research based on a hermeneutic approach is directed to the issue of maintaining a high level of objectivity (Repstad, 1999). The criticism is based upon the belief that the research becomes biased by the investigators own values and prejudices. However, Guneriussen (1997) claims that this is not always the case since some situations do not require interpretation due to the fact that they are so obvious for everyone. As a result, these situations can not be misinterpreted and by that high objectivity is reached. This motivates the use of a hermeneutic approach in our research since objectivity still can be obtained. An open approach together with three persons with different roles interviewing the respondents will contribute to higher objectivity in this thesis.

The positivistic philosophy aims at finding linear causality between observed parts whereas this research focuses on more complex issues were interaction is a more suitable way of generating knowledge as in the concept of "*General Systems Theory*" (Avgerou, 2000).

The thesis will use the hermeneutic approach as the underlying philosophy based upon the above discussion and the fact that this thesis requires pre-understanding and interpretation through the entire process of the research. This includes interpretation and an increased understanding regarding theories as well as the information gathered through the empirical study to the analysis and then finally to the end conclusions. Based on hermeneutic as the underlying philosophy for this thesis the research approach is selected.

2.2 Research approach

Three main research approaches exists, namely the deductive-, inductive- and abductive approach (Wigblad, 1997). The selection of an appropriate approach has to be based on the problem definition and the theory of science (Lundahl & Skärvad, 1999).

As mentioned by Avgerou (2000), IS research is issue-oriented rather than theory driven which is in correspondence with an inductive approach. This thesis is more issue-oriented and focuses more on the case study for finding effects and consequences rather than hypothesis testing based on existing theories. Further, an inductive approach is usually combined with a qualitative research method and with hermeneutic science (Wigblad, 1997; Bryman & Burgess, 1999) as in the case of this study. An inductive approach starts with the empirical data and thereafter creates theories based upon these facts (Lundahl & Skärvad, 1999). The deductive approach is based on already established theories and then draws logical conclusions and test (verify or falsify) these through empirical studies (Lundahl & Skärvad, 1999). However, it is possible to use these two approaches in combination which is defined by Björklund & Paulsson (2003) and Wigblad (1997) as an abductive approach. The abductive approach can best be described as a reciprocal action between theory and empiricism (Wigblad, 1997). The positive aspects of the abductive approach according to Wigblad (1997) are the possibility to include several perspectives to reach a complete picture of what is being researched.

A pre-understanding of the topic which is being studied is necessary to have in order to generate meaningful research questions (Wigblad, 1997). Since the thesis topic and purpose is relatively new it is difficult to find any existing theories to evaluate and test. Therefore it is necessary to go out and observe to gather information of existing practices and interpret this to create new theories based upon this new knowledge. Still there is a need for fundamental knowledge within the topic initially to gain a pre-understanding to base the research questions and observation on.

The above arguments are in correspondence with the inductive approach. Because this research is not concerned with testing already established theories versus practice it is not suitable to adopt a deductive approach. Further, there is no intention to create a hypothesis to get a simple yes or no answer. For the purpose of this study it is essential to reach a deeper understanding concerning effects for the business and related consequences for its processes to be able to draw valuable conclusions. However, these conclusions can not be seen as "laws" for each case due to the complexity, though it is still of higher value for this area of interest to gain a deeper understanding than only focusing on establishing a simple "law". Due to the limitation of time in this research and lack of existing theories, the abductive approach will not be considered. According to Wigblad (1997), the abductive approach would span a longer period of time and often take several years to complete. Hence, the inductive approach is most suitable for the purpose of this thesis and will guide the choice of method.

2.3 Choice of method

The choice of method must be in accordance with the entire research approach and based on the selection of an inductive- or deductive approach or combination of these two. Two research methods exist, the quantitative- and the qualitative method, or a mix of both (Halvorsen, 1992). A deductive approach assumes exactly what constitutes a meaningful area of investigation and the formulation of precise problem statements (Halvorsen, 1992). The deductive approach is according to Bryman and Burgess (1999), Halvorsen (1992) and Wigblad (1997) often associated with a quantitative method. The inductive approach is more concerned with developing a thorough understanding of the phenomena being studied without much previous knowledge and no stated hypothesis (Halvorsen, 1992). This can be rolled out with a vague and explorative problem definition. The inductive approach often implies a qualitative research method (Bryman & Burgess, 1999; Halvorsen, 1992; Wigblad, 1997). The choice of method for this thesis is therefore aligned with the last statement and uses the qualitative research method for studying the phenomena of implementing a real-time IT-Logistics solution. This includes finding the business effects of such an implementation and related consequences for its processes.

Kumar (1999) also agrees to the fact that it is the type of information which is sought that decides the choice of method. According to him the choice is dependent on three criteria, the purpose of the study, how the variables are measured and how the information is analyzed (Kumar, 1999). The following discussion covers the differences in the quantitative- versus the qualitative approach based on these criteria.

The quantitative method involves some kind of measurement which should be reliable and valid (Lundahl & Skärvad, 1999). Mark (1996) defines quantitative method as the approach which study phenomenas using numerical means. In these approaches there is an emphasis on counting, describing and using standard statistics, such as means and standard deviations. A quantitative method is more suitable for high-structured research that can be statistically measured (Wigblad, 1997). High-structured research is more formal, with standardized research questions. This leaves little room for variance and interpretation. Further, Wigblad (1997) claims that higher complexity should be followed by a lower level of structuration which a qualitative method represent. An example of this which corresponds with this thesis is a dialog with more open answers that can be followed up by complementary questions compared to a more standardized (high-structured) research approach.

According to Bryman and Burgess (1999) the tendency for quantitative researchers are to reach generalized findings while contextual understanding outlines the basis for qualitative research.

The qualitative method is defined as a research or study which implies to generate results and conclusions with the help of qualitative analyzes and mainly with qualitative data (Lundahl & Skärvad, 1999). The purpose with this method is to describe, analyze and understand the behaviour or impact of a certain phenomena often by using hermeneutic science (interpret and analyze) so a new theory or understanding could be outlined (Repstad, 1999; Lundahl & Skärvad, 1999). Mark's (1996) definition has almost the same significance since he states that the qualitative approach studies phenomena using general description to describe or explain them. Also, narrative descriptions of persons, events and relationships tend to be used by the researchers who use the qualitative approach. An example of this could be according to Kumar (1999) a description of the living conditions of a community where a numerical measure is not sufficient to cover their independent behaviour and its impact on the conditions as a whole. Further, the findings is often presented in general statements about the complex nature of persons, groups or events (Mark, 1996) as in the case of this thesis.

Repstad (1999) describes that with the qualitative method one is better able to reach a depth and nearness in the study and at the same time attaining flexibility. Nearness to the phenomena which is being studied is one of the ideal when it comes to the qualitative method. It is possible to have a close relationship with the object you are researching since you as a researcher could attain a deeper understanding compared to the quantitative approach where the researcher needs to be more or less completely objective. Additionally, this gives the opportunity to be more flexible regarding the information you collect and interpret. As an example of flexibility which is applicable for this thesis one could mention that it is possible for the researcher to change and adapt the questions depending on the answers given by the respondent (Repstad, 1999).

The above discussion gives the view of a divergence between the two approaches. However, both Bryman & Burgess (1999) and Wigblad (1997) conclude that the differentiating features are not that distinct. Wigblad (1997) mentions that the quantitative research studies also could be subjective like the qualitative approach but by that, it does not mean that it is negative for the result or conclusion of the research study. Bryman & Burgess (1999) has a discussion about whether the quantitative-qualitative contrast still has credibility or not, since some qualitative researches uses a theory-based approach instead of an empirical-based approach. Thus, the choice of method is and should not be so strict by following some certain rules. Most important is that you are aware of the differences and how you can apply each approach to your own research.

Within the qualitative research method there are different ways of how to carry out the research since one can choose which depth it should have. For instance, one could choose to have many respondents to get a broader view but not receiving an in-depth understanding about the phenomena the researcher is studying. A more in-depth approach could be a specific case and thereby doing a case study which will be the focus of this thesis. Merriam (1994) defines a case study as a research where a specific phenomena, like for example a special event or some course of events is being researched. Merriam (1994) continues by claiming that a focus on only one certain phenomena (the case) one is able to illuminate the vital and typical factors for that phenomena. When reaching such depth, one is able to draw conclusions which could be generalized for other similar cases.

This thesis is more concerned with contextual understanding related to the implementation of a real-time IT-Logistics solution and of describing and explaining nature due to the identified effects and consequences of an implementation. Because of this, an inductive approach together with a qualitative research method is considered most suitable to fulfill the purpose of this thesis. Further, the thesis will be researching a specific case and therefore, a case study research of a supply network including a subcontractor, manufacturer and an system developer will be carried out. The result of this case study represent the effects for the business and the consequences for the processes by implementing a real-time IT-Logistics solution together with finding the critical success factors by using a qualitative method.

2.4 Information gathering techniques

The selection of information gathering technique and the choice on how to organize, gather and interpret the information is depending on which general philosophy and theoretical approach the research is based upon (Merriam, 1994). In this case the thesis will be using both literature studies and interviews to gather information since the method chosen advocates to first get a pre-understanding and thereafter trying to reach a depth in the case which is being studied. Further, a discussion will be presented regarding the selection of respondents, design and procedure of the interviews and how collected data and information will be interpreted and analyzed. Some authors divide the type of information gathering into two categories, primary and secondary information. Primary data or information is when the researcher collects the data by himself and secondary data or information is when the data already exists but needs to be extracted from the source (Lundahl & Skärvad, 1999). Thus, normally primary data or information is collected through questionnaires, observations and as in the case of this thesis through interviews. Secondary data is collected through literature (Kumar, 1999) which constitute the theoretical foundation of this thesis. Secondary data or information in this case have been collected mainly through literature and scientific journals but also by using secondary documents such as corporate brochures to broaden the empirical understanding.

2.4.1 Literature study

The literature study in this thesis is used as a tool to attain and provide a pre-understanding and knowledge within the research topic. This is due to the fact that the topic is relatively new considering the purpose of this study and as a result of that more general theory exists compared to specific theories. Another aspect which is worth mentioning is the opportunity for the reader to attain a complete understanding of the research without having so much pre-knowledge within the topic. However, some theories and definitions might require some knowledge which will not be described in detail since it is not easy to identify every reader's pre-knowledge. The goal is also to try to find information regarding business processes and how they might change or adapt to new IT-systems.

The realisation of the literature study in this thesis is conducted through a certain method based on Merriam's (1994) discussion regarding the literature study. The procedure could be seen as very obvious but it is according to us relevant to present the way the literature study is conducted to be able to provide a better understanding of the procedure and the approach. First a fundamental search of literature is being done based on the definition of the problem and topic of the research. Literature like books, journals and work of reference within a certain subject field is selected mainly by using databases.

Thereafter a decision of which sources that should be included in the thesis to underpin the problem and purpose needs to be taken. It is also vital to know when there are enough sources for the thesis so a focus towards the purpose could be kept. Finally the structure and content of the theoretical framework is finalized and if needed some additional sources are added to ensure completeness and the existence of a red thread.

The literature study in this thesis will provide fundamental information (concepts and theories) regarding the Supply Chain and the Supply Chain Management to the theoretical framework. Further on it will discuss the development of these concepts as well as the impact it has on the organisation and its processes.

2.4.2 Interviews

The use of interviews in this thesis is equivalent to the empirical study. The empirical study in this case is an attempt to reach a depth and to attain a deeper knowledge of which impact an implementation may have on the business' processes. The definition of an interview is very simple, 'Any person-to-person interaction between two or more individuals with a specific purpose in mind is called an interview.' (Kumar, 1999, p. 109). Interviewing as a method of collecting information is commonly used according to Kumar (1999) and Merriam (1994).

The plan for the interviews for this thesis is to have the possibility to discuss openly with the respondent and ask questions that were not written down beforehand so you can be flexible and discuss interesting topics more deeply. Nevertheless, it is important to have some questions written down beforehand so you could make sure that you cover the areas needed. By using this approach we believe that a greater knowledge could be attained compared to using only beforehand written down questions. A classification exists of interviews, namely, structured-, unstructured- and semi-structured interviews depending on the degree of flexibility (Lundahl & Skärvad, 1999). We interpret the meaning of standardized as the same thing as structured in this case. This is based on the explanation that Lundahl and Skärvad (1999) gives for the word standardized and we will therefore use the word structured to be consistent with the other authors. With a high degree of structurization, the questions are pre-determined and the order as well. An unstructured interview is very flexible and the interviewer only uses a guide of how to carry out the interview. The last way of conducting an interview is by using the semi-structured approach which is a combination of both structured and unstructured. Here one might have some pre-determined questions but could expand those questions during the interview by having follow-up questions to reach a satisfying depth. The advantage of a less structured interview is that the answers could become more comprehensive (Lundahl & Skärvad, 1999). On the other hand, the main advantage of structured interviews is that they might provide more comparable information and are therefore easier to generalize (Kumar, 1999). To reach the desired depth, which is important for attaining good knowledge about the implementation's impact in terms of consequences for business processes not just the effects, this thesis will be using the semi-structured approach as one of the information gathering techniques. This will give the benefits of being able to follow-up and expand the interview to reach a two-way discussion around each of the questions. A clear advantage can be gained by having a semi-structured approach in this thesis through little guidance of the interview and more in the form of a discussion which will better ensure coverage of all areas of interest. This will also lead to higher objectivity since the respondents are free to talk around the questions assuring correspondence.

Structured interviews are foremost suitable for hypothesis- and theory testing studies according to Lundahl and Skärvad (1999). The unstructured- and semi-structured approach are particularly useful in situations where either in-depth information is needed or little previous knowledge exists within the area as in the case of this thesis (Kumar, 1999; Merriam, 1994). These statements by Kumar (1999), Merriam (1994) and Lundahl and Skärvad (1999) justifies the semi-structured approach used in this thesis as choice of information gathering technique.

2.4.3 Selection of respondents

Lundahl and Skärvad (1999) argues for the importance of what perspective is chosen in relation to the phenomena which is being studied. The selection of perspective in this thesis is based on three perspectives to get a holistic view. These perspectives are the: system developer-, manufacturer- and the subcontractor perspective. In this case the manufacturer is one who implements a real-time IT-Logistics solution, the system developer is one that has provided an IT-solution to a manufacturer and the subcontractor is one that gets affected by the change made by the manufacturer requiring implementation of the same interface. To use several perspectives increases the level of objectivity regarding diversification, completeness and unbiassedness (Lundahl & Skärvad, 1999). This is evident because the information gathered from these different perspectives may be divergent and a completely objective picture can therefore only be gained by including all these perspectives. When analyzing the information these perspectives will be compared to reach a more accurate view of the effects on the business and the consequences for its processes by implementing a real-time IT-Logistics solution.

The main criterion in the selection of interviews using the qualitative method is according to Repstad (1999) that the respondent has important and relevant information about the research topic and its problems. Thus, it is the problem definition and the purpose that decides the selection of respondents. We will therefore choose respondents that we think have a good knowledge about the effects and consequences when implementing a real-time solution. Merriam (1994) divides the selection into two types, probability- and non-probability selection. The most common type in qualitative case studies is the non-probability selection. The non-probability selection is also the one that corresponds best with Repstads (1999) choice of selection-method. Within the non-probability selection two strategies exists, either targeted strategy or criteria-related strategy (Merriam, 1994). Targeted strategy is based upon the wish to explore, understand and attain knowledge. Hence, the researcher selects the respondents where he/she could attain most knowledge. However, criteria-related strategy is based upon a selection where the respondents need to fulfill some defined criteria chosen by the researcher and thereafter a selection is made of those that fulfill these criteria.

Thus, based on the arguments by Merriam (1994) and Repstad (1999) the respondents in this thesis will be selected in a non-probability approach with the use of some basic criteria listed in table 2.1. The reason behind these criteria are logical thinking of what kind of companies and situations that are interesting in order to fulfill the purpose. We need a large sized company so the change for the company is complex enough. Further, we need a company that has recently done an implementation so it remembers the differences compared to the old system. We also want to use several perspectives so we can get a holistic view and a more complete understanding of the impact an implementation could have.

Following Repstad's (1999) method, the respondents for this thesis need to have knowledge within the field of supply chain management and experienced a project where an implementation of a real-time IT-Logistics solution has taken place. Further, the respondents have to be able to reflect and draw conclusions regarding the effects and consequences the implementation has had, otherwise it would not provide any value for the thesis. Adding Merriams (1994) method as well will form the basic criteria that need to be fulfilled.

Criteria for selection of respondents
A large sized manufacturing company so the impact of implementing a real-time IT-Logistics solution will be substantial and more evident compared to a smaller company.
A company which has recently done an implementation of a real-time IT-Logistics solution.
A company where at least three actors (system developer, manufacturer and subcontractor) where involved and/or affected by the change.
The system developer has good experience in implementing real-time solutions in general.
There were subcontractors that got affected by the implementation.

Table 2.1 Criteria for selection of respondents.

The selected companies and respondents are listed below, followed by a short business description.

1. **PipeChain AB**.

   PipeChain develops, markets and supports the PipeChain software suite and is Scandinavia's most experienced supplier of Vendor Managed Inventory (VMI) projects. The software is developed in Sweden by people with almost 30 years of experience in supply chain issues, change management and system design.

   PipeChain AB is owned by MA-System and Consafe Logistics. The company group is active in most aspects and areas of logistics. The group has 200 employees, a turnover of 250 million SEK and has costumers all over the world. PipeChain has about 100 clients.

   PipeChain's customer base consists of companies from various industries and sizes. Ericsson, Smith-Blair, Smurfit, Molnlycke Healthcare, SCA and Volvo are companies that are expanding their use of PipeChain not only in existing sites but also by adding new sites and partners.

   Respondent: Håkan Jöne, Key Account Manager - PipeChain

2. **Metallfabriken Ljunghäll AB**.

Ljunghäll's competence lies in technically advanced die-cast goods and has 700 employees. Their head office is located in Södra Vi in Sweden but they also have offices in Gothenburg, Stockholm and Malmö. Ljunghäll have existed since 1917 and is one of the leading die-casting companies in Europe. Their annual turnover year 2004 was 1 034 million SEK. They are also a subcontractor to Volvo Powertrain AB where they support them with custom-designed goods.

Respondent: Anica Sonnerstig, Logistics Manager - Metallfabriken Ljunghäll

3. **Volvo Powertrain AB**.

Volvo Powertrain is one of the world's leading manufacturers of heavy diesel engines and transmissions. The company has operations in Sweden, France, and the US. The number of employees is 8 000. Their turnover 2003 was 12 641 million SEK.

Volvo Powertrain coordinates Volvo's driveline activities and supplies the entire Volvo Group with driveline components, such as diesel engines and transmission which are either developed and manufactured by Powertrain or purchased.

Respondents: Tomas Mörk, Manager for global process- and system development & Lena Breman, Project Manager for PipeChain rollout - Volvo Powertrain

2.4.4 The design and procedure of the interviews

The tool used to collect data needs to be well developed so that correct data could be collected and analyzed. In the qualitative method this tool is often the interview guide which is used as foundation for the interviews. The design of this interview guide is therefore important and the content of it needs to reflect and be motivated by the purpose. As stated in Chapter 2.4.2 a semi-structured approach for the interviews has been chosen. The interview guide is more open and not so strict due to that approach since complementary questions are asked and the researcher is allowed to lead the interview differently based on each situation (Lundahl & Skärvad, 1999).

The guide of the interview needs to have a good opening so the respondent feels comfortable in the beginning of the interview (Repstad, 1999). Lundahl and Skärvad (1999) mentions that background questions is a good start of the interview. An example of this could be questions like; *Tell me a little about your history in this company?* and *How come that you started working here?*. Both of these questions are easy for the respondent to answer since the questions are related to the respondents own life and experiences. Later on, the interview guide could allow the researcher to go more deeply and have more focus towards the research problems and purpose. The interview guide should according to Repstad (1999) end with questions that allow the respondent to add additional information or the possibility to correct some answers. The reason for this is that the respondent should not feel that anything was unsaid or a slip of the tongue was made.

Kumar (1999) discusses the order of the questions in the interview, either the questions are asked in random order or they follow a logical progression. Kumar (1999) advocates the latter, since that approach is keeping the interest of the respondents and encourages them to gradually answer more complex and in-depth questions.

Further on, the more practical issues for the interview will be presented in short below. When conducting the interviews there will be one person who asks the questions and two persons taking notes, this method is used to minimize eventual misunderstandings or misinterpretations. This will be done dynamically so it will not be the same person who asks all the questions during the whole interview. One of the persons will be in charge of making sure that everything is covered in the interview guide and that enough information has been collected.

The interview guides for this thesis can be found in appendices 2-4. The interview guide which is sent beforehand is intended to give the respondent an idea of what kind of questions that will be discussed throughout the interview. The questions given in the guide are more topic-oriented compared to the actual interview questions and will be supplemented by follow-up questions when performing the interviews.

2.4.5 Interpretation and analysis of the data

Data does not speak for itself, it has to be interpreted. The analysis of the data is the process where one is trying to gather and present the data in such way so it has a good structure and becomes easy to understand (Repstad, 1999). During the analysis the information is being consolidated, reduced and in some cases interpreted (Merriam, 1994). The goal with the analysis is to be able to come up with trustworthy conclusions which are based on the empirical data.

When carrying out the analysis it could be a good idea to go back and look at the initial problem discussion and purpose to ensure the connection to the purpose (Merriam, 1994). Halvorsen (1992) mentions that the data that is analyzed is usually interviews written down. The data needs to be interpreted and it is then vital that the researcher performs this with objectivity so the respondents recognize the information in the analysis (Halvorsen, 1992).

The process of handling the data in this case is to write down the interviews after conducting them and then read and analyze that information through interpretation. If a lot of information exists in one interview it might be useful to make it shorter by selecting the most distinct and interesting comments. A draft of this composition will be sent to each respondent to make sure that they have been understood correctly which makes it possible for them to correct minor errors. After this is completed we will analyze the information as mentioned above where a comparison will be made between the interviews. This comparison is vital in order to reach a complete and accurate view regarding the effects for the business and the consequences for its processes by implementing a real-time IT-Logistics solution. Based on this view we will compare the empirical study and the theoretical framework by analyzing the data which has been collected in relation to existing theories. To reach a generalized conclusion drawn from this analysis, a modelling approach will be used to connect the effects to related consequences on business processes and find cross-relations. By combining the data gathered from the empirical study with existing theories as well as own interpretation the critical success factors could be presented. These critical success factors need to be evident in order to perform a successful implementation of a real-time IT-Logistics solution and to reach the desired effects of such solution. The effects are easier to identify and describe but the consequences require more interpretation and analysis in order to find and explain the impact these effects will have on the business processes.

2.5 The trustworthiness of the research

All research aims to provide valid and approved results in an acceptable ethical way (Merriam, 1994). Compared to quantitative studies the qualitative studies are harder to measure when it comes to validity and reliability since one could decide the validity and reliability beforehand more or less when using quantitative methods. For that reason, Lundahl and Skärvad (1999) believes it is salient that a discussion regarding these issues is held in a qualitative study. The discussion will strive to clarify the definitions and thereafter connect it with the thesis' approach and working method.

2.5.1 Internal validity

The definition of internal validity is more or less the question if the "*instrument*" the researcher is using actually measures what it is supposed to measure (Lundahl & Skärvad, 1999). The instrument could for example be interviews, surveys or some other technique. So what really is being asked is if the research method and information gathering technique is valid enough for the purpose of the research (Mark, 1996).

As everything is done by the researchers in a study it is their obligation to present the data in such an honest way so the respondents and other informants can feel recognition with the data and result (Merriam, 1994). By doing this the internal validity becomes a definite strength in the research. However, a problem could be that the researcher thinks and interprets something as true but in fact it could be the other way around. This might be due to the fact that the researcher simply misunderstood the explanation or that the researcher had a prejudice in that question based on the theory or the wish for a certain research outcome. Every result is a result and even if the result does not correspond with what the researcher had in mind from the beginning it does not mean that it is not interesting and not having a high validity.

To maintain a high internal validity in this thesis a focus towards an open approach will be chosen where we will have an open mind and not have any wish for a certain outcome as well as present the data in the most unbiased way by having three persons attending and listening to each interview. By having three persons present at each interview, factors like misunderstandings, information losses and misinterpretations will be minimized. Case studies tend to go more deeply into the subject which is being researched and by that it contributes with a more complete view over how things work which improves the possibility for high internal validity. Further on, we believe that the research approach and the instrument chosen for this case study is valid enough for the purpose of this research.

2.5.2 External validity

In general, the more one is able to generalize the result of a study the higher value it receives as long as the findings are valid. External validity is mentioned by Merriam (1994) as to which extent the result from a certain study is applicable to other similar situations. So one could say that external validity is the same as generalization. In order to even consider and discuss the external validity one need to make sure that internal validity is fulfilled. Not having internal validity means that the information is more or less useless and there is therefore no reason to generalize such information. However, Merriam (1994) states that qualitative studies usually have a high internal validity, rather than external validity, which could be hard to accomplish. Additionally, one needs to be aware of, that in some cases a high degree of external validity is not the goal with the research (Merriam, 1994).

Sometimes, a certain case is so special and important that it is very interesting to research, but it is almost impossible to generalize the findings.

The interest and hope with this thesis is that the research will find factors that were crucial for success when implementing a real-time IT-Logistics solution and that some of these factors are applicable to other companies and supply networks as well. The main interest however is to find what kind of effects and consequences this implementation causes on the business and its processes. These could later on constitute the foundation for other companies that are considering to switch to a real-time solution for their supply chain network.

2.5.3 Reliability

The structure of this research and the choice of method could make it hard to reach a high reliability. We will however try to present our methods and the material used for this thesis in a clear and consistent way in order to attain a high reliability. The interview guides and the plain research method will contribute to this. In each research there will always be a questioning regarding the result and its reliability. If the research should be carried out again with the same research method, will it provide the same result as last time, is usually the most common question from sceptical readers. This is the arguments for reliability according to Merriam (1994) and Halvorsen (1992). Kumar (1999) has a similar definition of reliability where it is the consistency and stability of the research tool which for this reason causes the result to be predictable and accurate. Kumar (1999) continues by stating that 100 percent accuracy is impossible to have since there are some factors which affect the reliability that the researcher can not control. An example of this could be that the respondent interprets the questions differently at different times. Merriam (1994) argues for concentrating on the internal validity instead of the reliability due to the fact that the internal validity affects the reliability. However, one still needs to consider the structure of how the information was collected so it could be used like a manual for repeated study (Merriam, 1994).

The reliability in this research is reached by having a plain and structured research method. The interview guides are also presented in the appendices (2-4) so the same questions could be asked again if someone would like to conduct the research ones again. Additional persons with different perspectives are interviewed and that excludes the problem with only one talking in favour for its own business or case. Thus, conducting the research again and having this holistic view would secure that the result would be the same or very close to it since it is not only one person that affects the result.

3 Theoretical framework

The focus of the theoretical framework is to give the reader an understanding of the subject. Additionally, the frame of reference will lay as a foundation for the analysis in the thesis where a comparison between theories and the empirical study will be conducted. Therefore, we have tried to identify the suitable theoretical areas for creating an understanding which are connected to the purpose of the thesis. We have created a figure to visualize the sections within the theoretical framework. The figure gives a detailed description of the theoretical framework's disposition.

The figure shows that the theoretical framework is divided into three main parts:

- An understanding of the supply chain and management together with the concepts and technologies involved (Ch 3.1 – 3.3).
- Theories concerning organizational aspects with a business process approach and strategies connected to SCM. To highlight the importance of strategic alliances it is presented in a separate chapter (Ch 3.4 – 3.5).
- The third part brings the first two parts together and focuses on organizational impact when it comes to integration of business processes and IT with its consequences (Ch 3.6).

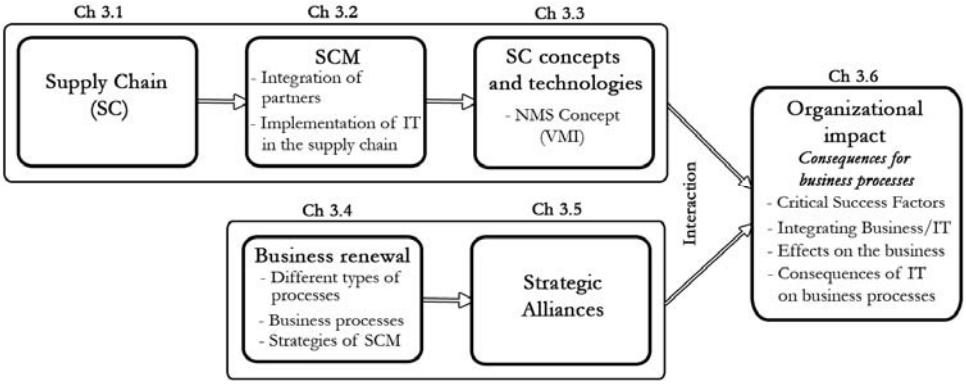

Figure 3.1 Description of Theoretical framework

3.1 The Supply chain

Supply chain and supply chain management are concepts that have increased in importance the last years (Paulsson, Nilsson & Tryggestad, 2000). New factors in the business environment have made the supply chain very important to consider. The most significant factors are the fast development of IT, the reduced business barriers, lower transportation cost and large-scale production (Paulsson et al., 2000).

A supply chain can be described as a collection of functional activities which reaches over the whole company and its business network with other companies. These activities convert raw material into finished products and add customer value (Ballou, 2004).

Paulsson et al. (2000) define the supply chain in a similar way and claims that the supply chain covers the whole chain of processes from raw materials to the finished product.

The main goals with a well functioning supply chain are that the customer should receive the right product at the right time to the right cost. In order to manage this it is necessary to see the whole chain as a unified process where all parts of the business are included (Paulsson et al., 2000). We think this is a key aspect to consider in order to perform a successful implementation of a real-time IT-Logistics solution between business partners.

'The supply chain encompasses all activities associated with the flow and transformation of goods from the raw material stage, through to the end user, as well as the associated information flows.' (Ballou, 2004, p. 5).

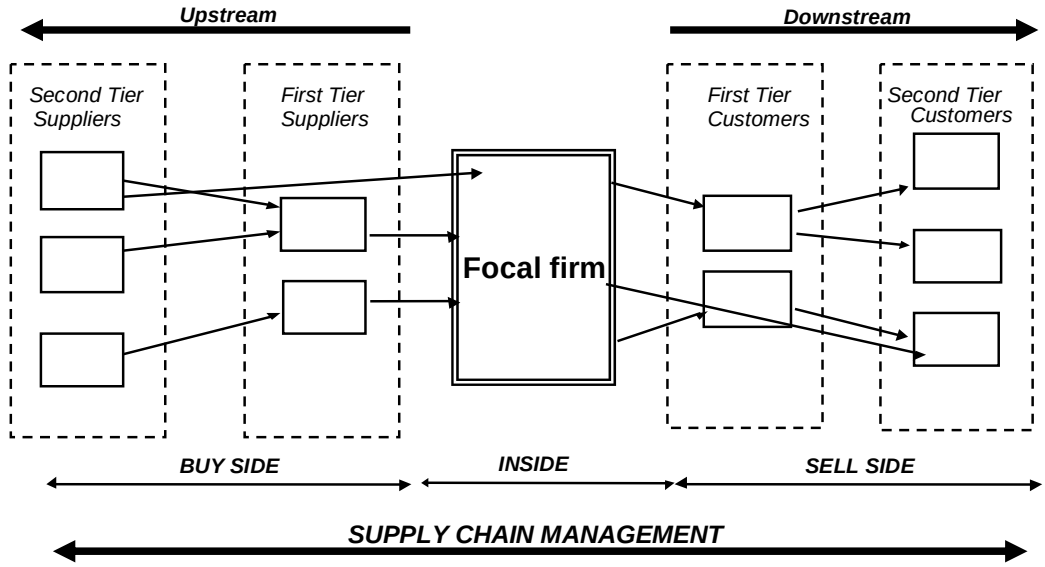

Figure 3.2 Supply Chain Management.

(Revised from Harrison & van Hoek., p. 8, 2002)

The main purpose for logistics is to create value for the company's customers, suppliers and other stakeholders to the organization. The value of logistics is usually expressed in terms of time and place. Time and place are the underlying factors in order to generate value from the logistics activities.

The supply chain absorbs as much as 60 to 80 percent of a sales dollar (Ballou, 2004). Therefore it is of great importance to evaluate and analyze how the supply chain activities can be done more efficiently. This thesis focuses towards these types of activities, when a real-time IT-Logistics solution is implemented within the supply chain. This is done by many companies and the supply chain is becoming more and more essential to the firm's competitive strategy (Ballou, 2004).

The supply chain concerns many different processes and activities within the company. It could be everything from transportation, inventory maintenance, order processing, purchasing, warehousing, production etc (Ballou, 2004). Today's market is highly competitive and companies need to constantly redefine their strategies in order to survive on the market. The activities within the supply chain varies, depending on the organizational structure (Ballou, 2004). Mentzer (2004) also argues for this and states that an efficient supply chain results in a competitive advantage in today's global marketplace.

Therefore it is a strive to constantly develop and improve the supply chain in order to get competitive advantages. In order to manage an effective and efficient supply chain, it is necessary to have a strategy and clear goals for the firm's supply chain (Cohen & Roussel, 2004). Companies such as Wal-Mart and Dell use the supply chain as a strategic differentiator against their competitors. They have a business strategy to always search for new ways for adding value by refining their supply chain and be one step ahead of their competitors (Cohen & Roussel, 2004).

Since this thesis brings up the development of the supply chain, it is interesting to know that the development has gone from vertical integration to traditional supply chains to e-supply chains (eSC) according to Williams, Esper and Ozment (2002). E-supply chains are based upon electronic communication with the company's partners and result in effective responsiveness towards their customers. With an eSC, companies receive customer orders directly which leads to faster order-processing and shorter cycle-times for orders (Williams et al., 2002). A major difference between the eSC and the traditional supply chain is that the eSC is based on technology-enabled relationships. Since eSC has an electronical base the system becomes adaptable to new situations and has a relatively low switching cost (Williams et al., 2002).

3.2 Supply Chain Management (SCM)

Ruppel (2004, p. 311) defines Supply Chain Management (SCM) as 'the coordinated flow of material and products across the enterprise and with trading partners, but also the management of information flows, cash flow and process/work flow'. Ballou (2004) defines SCM in a similar way and claims that SCM is much about coordinating product flows across functions and through different companies in order to achieve competitive advantages. An efficient coordination should create profitability for both the individual companies and for all supply chain members collectively (Ballou, 2004).

Paulsson et al. (2000) states that the supply chain consists of three main flows. These are: the physical-, information- and the financial flow. Often, the physical flow can receive too much focus compared to the information- and financial flows (Paulsson et al., 2000). It is important to see all these processes together and analyze them as an integrated flow through the whole supply chain. The physical flow consists foremost of the products, but also packing material means of transport etc. The information flow should support the physical flow to be as efficient as possible. The focus of financial flow is on the financial transaction between the partners and to make that as efficient as possible (Paulsson et al., 2000).

Since the market is uncertain, the supply chain needs to deal with market uncertainty surroundings in various ways. Without an effective supply chain management, it is common to have high levels of inventory and product shortages. Such problems of mismatch in supply and demand along the supply chain are often caused by uncertainty (Kwon & Suh, 2005). This uncertainty can be managed with an Information System, in order to forecast and share information amongst other partners within the supply chain (Kwon & Suh, 2005). There are three elements in the framework of SCM: supply chain structure, management components and business processes. These elements need to be analyzed and evaluated in order to understand how to operate and integrate them in a better way (Wu et al., 2004).

Ballou (2004) claims that it is important to identify each activity in the supply chain and see how it contributes to the value added process. Ruppel (2004) agrees to this and claims that one of the main underlying concepts of collaborative commerce is SCM which gives a competitive advantage for the companies involved. SCM can be viewed as a concept that includes all value adding activities, from raw material to the final, delivered product. All these value adding activities can be viewed as different processes within the business, and changes of the SCM structure will affect these processes (Wu et al., 2004). The driving forces behind SCM investments in 2002 are increased productivity and efficiency by automating business processes to meet the fast changing customer demand (AMR, 2004).

3.2.1 Integration of partners within SCM

An essential factor for successful supply chain integration is based on information sharing and trust among the different stakeholders within the firm's SCM (Kwon & Suh, 2005). Both trust and commitment need to be present in a relation between the company and its suppliers in order to promote the efficiency level of the supply chain (Kwon & Suh, 2005). We believe this is an important aspect to consider in order to succeed with an implementation of a real-time IT-Logistics solution. SCM promotes strong integration with other business partners, mainly with the firm's customers and suppliers. It is of high importance to make this integration efficient and to use it as a competitive advantage versus the firm's competitors (Wu et al., 2004).

Wu et al. (2004) further claims that there are three different categories of factors that are significant for business process integration within SCM. These categories are: SCM commitment, marketing determinants of SCM and behavioral determinants of SCM. Kwon & Suh (2005) also emphasize the dependence between trust and commitment. Commitment is built upon trust and all partners need to feel secure among the supply chain partners. We agree with that and think it is a key area to consider in order to have a well functioning supply chain.

Ruppel (2004) discusses the same area and claims that organizations must create a foundation of mutual trust and commitment to reach full collaboration. Further, Ruppel (2004) states that the ability to secure the software solutions may have a huge impact on the decision to use this kind of solution or not for integrating the supply chain partners and create commitment among them. Wu et al. (2004) emphasize the importance of evaluating these categories and claim that it is a correlation among them. SCM commitment plays an essential role and has a direct impact on the processes within SCM. All stakeholders need to be committed to the partnership and willing to make sacrifices to maintain a long term relationship (Wu et al., 2004). Marketing determinants of SCM has a direct impact on SCM commitment and the integration of the business processes.

Helo and Szekely (2005) also discuss this and claims that an extended enterprise model, by sharing information across organizational boundaries will have the potential of: improving the time to market, cost reductions and allowing all the parties involved to better manage their current resources for future needs.

Williams et al. (2002) have on the other hand a different view on the old and new way of handling SCM. If one compares the new way of handling SCM and the old way one can see some major differences. The old system advocates long-term collaborative relationships while the new way is more flexible and dynamic when it comes to relationships. However, this does not imply a weak relationship, in fact it is the opposite given that you are well aware of the terms the new way has when it comes to the underlying goal.

The old way has increased stability and long-range cost benefits as an underlying goal while dynamic capabilities like adapting to changes in highly unpredictable situations constitutes the new way. According to Williams et al. (2002) the new way is more or less like a hybrid of the traditional arm's length and the traditional supply chain approach, where the new way uses the best things from each way. This new way is based on relationships as long as it fulfills the business objectives. One can say that the company searches for the resources needed and when it has found a good resource, a connection is made but only for as long as it is needed. If the cost reaches such a high level where it is not beneficial, the company can easily uncouple and create a new connection with a new partner. This is something that Williams et al. (2002) defines as the "re-linking concept". The objective in the new SCM way is meeting goals, not maintaining collaborative relationships as with traditional SCM. Hence, the relative value of partnerships and alliances has become a salient issue according to Williams et al. (2002).

Kemppainen & Vepsäläinen (2003) is more or less sharing the ideas of Williams et al. (2002). In order to see the coming trends one needs to understand how everything began and understand the development of Supply Chain Management (Kemppainen & Vepsäläinen, 2003). In the beginning, there was a focus on the operational issues with the goal of having an efficient material flow. McMullan (1996) stated that in the mid 1990s inventory management and competitiveness were the key factors of SCM. Companies were only looking for having collaboration with the closest partners in the supply chain and companies outside were not given any attention.

Nowadays, this has changed since the companies are aware that a simplified supply chain illustration does not work. The companies have to live with uncertainty and that relationships are impossible to tailor and do not fit into a certain category. The structure that is very common today is the extended supply chain which is focused more towards information sharing within a multi-tier structure of relationships (Kemppainen & Vepsäläinen 2003). However, this is not applied in a satisfying way according to a study made by Kemppainen and Vepsäläinen (2003). It seems like it is only the key partners that has access to the information needed while other suppliers and customers have to cope with the uncertainty.

The future trend tends to be more focused towards service, collaboration and increased flexibility. Kemppainen and Vepsäläinen (2003) also mention that real-time information sharing within the supply chain is something that will be common in the future. Another view of the supply chain is that it will be seen as major contributor for maximizing the total revenues. Helo and Szekely (2005) also discuss future trends and claim that processes will be externally connected with a web-based architecture. Hence, new challenges will arise due to integration issues with other supply chain systems.

Further, there will according to Helo and Szekely (2005) be an increase in the information sharing between different companies which creates a need for standardization of the data exchange between organizations. Ruppel (2004) claims that the key to long term value is open communication. When establishing a relationship with another corporation, a company opens up and gives away a lot of information, therefore it is crucial to attain mutual trust between the parties so that one can be assured that the information will not be exploited (Ruppel, 2004). One of the main reasons inventory levels could be unnecessary high is exactly because of this, the lack of trust between the parties involved leads to excess inventory (Ruppel, 2004). We think this is important to consider when it comes to the integration of partners within the supply chain.

3.2.2 Implementation of IT in the supply chain

A fast development of information technology has given the information flow within the supply chain a more central role than before (Paulsson et al., 2000). IT is a very important component within supply chain management and the development of IT has created many new opportunities for managing the supply chain (Paulsson et al., 2000).

Vollmann, Berry, Whybark and Jacobs (2005) discuss the same issues as Paulsson et al. (2000) and mention systems that can improve the integration of business processes with the supply chain. One system that Vollmann et al. (2005) discuss is a Manufacturing Planning and Control system (MPC). In order to integrate this MPC system with other actors within a firm's network it is necessary to use an e-based MPC system (Vollmann et al., 2005). This type of systems link companies via the Internet and facilitates information sharing among them. This allows for real-time coordinated planning for the company and its suppliers. E-based systems give opportunities between different actors to communicate about product knowledge, joint planning, chain demands/inventories etc (Vollmann et al., 2005). All of the transactions between the business partners should be performed electronically with little or no human involvement. These arguments from Vollmann et al. (2005) are aligned with the aspects that are considered within this thesis.

Vollmann et al. (2005) further claim that E-based MPC systems can reduce the need for ordering and forecasting. These systems give the opportunity to know exactly the situation of their partners (Vollmann et al., 2005). For example, the supplier does not need to forecast the customer needs and do not have to wait to get the orders. All partners can work independently within the supply network with full knowledge of the true needs of the different actors on a real time basis (Vollmann et al., 2005).

Vollmann et al. (2005) also claim that an "open book approach" needs to be applied in order to reach this knowledge about each other. However, an evaluation should be performed concerning the risks involved in information sharing with others before it can be applied. The concept is called "joint chain scheduling" and is a key goal of cross-firm MPC design. The main goal with the concept is to respond quickly to the end customers' demand within reduced time frames and with minimal inventory (Vollmann et al., 2005). The Vendor Managed Inventory (VMI) concept is one type of joint chain scheduling which takes care of the customers' demand. This leads to increased flexibility for the supplier and efficient replenishment for the customer (Vollmann et al., 2005). In order to make this work, it is necessary to have compatible systems that can support several standards of information flows from different actors. According to Vollmann et al. (2005) this can be done through an open IT-architecture with a common platform for all actors within the network.

However, it is necessary that each actor within the network does some adjustments within their own business. 'E-based MPC will always lead to the need for transformative change in work practices.' (Vollmann et al., 2005, p. 570). Since there are many processes within SCM that are connected to other companies it is essential to coordinate these to make them effective. This is done through information system integration together with planning and controlling activities (Wu et al., 2004).

The information system is the most important factor for a successful supply chain alliance. With an information system it is not only operational and financial data that is shared among the supply chain partners. Also, vital strategic information is shared, such as forecasting, goals, and process design (Kwon & Suh, 2005).

Li et al. (2002) also talk about this and state that supply chain performance is supposed to be improved through the coordination of agents. An effective supply chain modeling approach is needed as a prerequisite for Internet technology enabled supply chain integration (Li et al., 2002). This is essential, to get an understanding of the complexity concerning the supply chain and being able to align the processes of the companies involved in cooperation. According to Li et al. (2002), the supply chain is a complex inter-firm network with several participants and processes.

The current methods in use for business modeling are more focused on the internal integration of autonomous firms and limited emphasis is given on the overall Business to Business (B2B) integration (Li et al., 2002). Therefore, Li et al. (2002) proposes a coordinated supply chain modeling approach which describes the coordination structure, interdependency, process and information flow, to form the basis for Internet based supply chain integration. The proposed model should be seen from four dimensions with a modeling technique constituting each one of them. First, a scenario model describes the total supply chain structure as a network of related companies with product and service flows. The network should be linked by Internet based technologies and applications. The interdependency model describes the relationships between the actors in the network. The process model gives a view of all the activities that manage the interdependencies and realizes the customer required products. Finally, the information model is generated based on the process requirement. The information is in the form of input and output of the processes and is distributed over the Internet. The models are related but describe different aspects that need to be considered.

According to Helo and Szekely (2005) the different software solutions for supporting the supply chains are becoming more and more overlapping in terms of functionality. Supply chain optimization software is one category of IT-solutions that focuses on optimization of future planning and scheduling activities of inter-enterprise material flows and related processes. This includes: Supply chain inventory optimization, capable to promise calculations, order decoupling, reduced inventory points, merge in transit and material flow analysis (Helo & Szekely, 2005). Helo and Szekely (2005) further claim that the optimization approach has been widely used in complex networks where central control is difficult to establish without data and communication systems.

3.3 Supply Chain concepts and technologies

Ruppel (2004) claims that the goal of most SCM software is to increase flows through collaboration. To ensure an effective use of SCM software, mutual trust must be established between the parties involved to facilitate information sharing. Managing internal supply chain links is as difficult as the management of the external ones (Ruppel, 2004). Therefore, if an organization has difficulties in sharing the information internally it will be hard to establish external information exchange.

It is essential to fully understand the underlying factors behind changes caused by an implementation of a supply chain software (Ruppel, 2004). This implies that technology, even though it is an important facilitator to SCM, is only one of the issues that need consideration when dealing with supply chains.

There are clearly some barriers to overcome, with company culture and trust being the key obstacles for a successful implementation (Ruppel, 2004). According to Ruppel (2004), to manage the organizational culture and the relationships within the supply chain are as important as the software itself. Not only implementation, but also using the technology effectively, will affect return on investment (ROI) and other performance measures. AMR Research Inc. (2004) found that as little as 16 percent of the implementations of supply chain software took less than six months with almost 20 percent of the projects taking longer than two years to be fully implemented. Ruppel (2004) also states this and claims that the most projects are taking more than a year.

To support the flows in the supply chain, a range of different SCM software solutions are developed from various kinds of vendors (Ruppel, 2004). Order- and inventory management continue to be the most frequently used SCM modules, implemented by more than 85 percent of companies with existing SCM software (AMR, 2004).

One major change in the manufacturing environment is the implementation of Enterprise Resource Planning (ERP) systems (Vollmann et al., 2005). Many ERP systems are based on Material Requirement Planning (MRP) systems and have Manufacturing Planning and Control (MPC) included. The integration of ERP and MPC systems increases the opportunities for effective management and enables an efficient supply chain (Vollmann et al., 2005). A major force that has created the importance of having an efficient MPC system is the decentralization of decision making to the factory floor. More advanced tasks are now made directly at the factory floor, as problem solving to be able to have a holistic view over the entire production.

Supply chain Resource Planning (SRP) is described as an integrated inventory management approach in which demand and inventory data requirements from the entire supply chain is met by Internet technology. This new approach to inventory decision systems lets all the partners within the supply chain, view and manage demand as well as capacity data.

Boughton and Kehoe (2001) agree with these abilities and claim that there is an enormous potential for this kind of integrated supply chains, since simultaneous improvements can be made to customer service levels and overall inventory reductions which in turn reduces costs. Further, the use of Internet as the enabling technology will make this integration easier in terms of system linkages and by lowering transition costs.

The problem with a common system infrastructure is no longer evident when establishing customer/supplier relationships due to Internet as a medium for data exchange. Boughton and Kehoe (2001) argue for an optimization of the entire supply chain instead of just focusing on the internal optimization.

An optimization of the entire supply chain can be done through Electronic Data Interchange (EDI). EDI consists of direct computer to computer transmissions among different companies. There are two different standards for EDI: the American National Standard and the International standard used in Europe. The EDI technique is dominant when it comes to implementation of inter-organizational information systems. More then two-thirds of electronic commerce is managed with EDI technology compared to other similar techniques which makes EDI the leading method for data interchange (McLeod & Schell, 2004).

While EDI has been an important SCM tool and been setting the standard for more than 20 years for data exchange between customers and suppliers, this is about to change somewhat. Many argue for an Internet takeover for this kind of interaction between businesses, replacing the traditional EDI networks, with 61 percent (of the 1000 companies involved in the survey) believing that this will occur in the next three years and 22 percent expecting the change to take place in the next five years (Ruppel, 2004).

3.3.1 The Networked Managed Supply (NMS) Concept

In many industries, supply chains are getting more and more complex and can better be described as supply networks (Gustafsson & Norrman, 2001). Gustafsson and Norrman (2001) describe a network as sets of inter-connected supply chains where lateral links, reverse loops and two-way exchange exist between the actors involved. The concept of Networked Managed Supply (NMS) is focused on real-time execution within supply networks. The underlying idea behind this concept is that customer's real-time demand should trigger the flow of goods within the network. The NMS concept is based upon the following principles:

- Real-time demand driven supply networks
- Vendor Managed Inventory (VMI) - The supplier takes the responsibility for automating replenishment towards the customer
- A strong partnership between customer and supplier
- Transparent and easily transferable information in the network
- A plain product strategy - states what products that should be produced to order and which should be kept in stock and where to store the goods etc.
- Real-time based decision making in every node of the network

(Gustafsson & Norrman, 2001)

Effective supply chains are more about information sharing than optimization (Gustafsson & Norrman, 2001). Optimization becomes more focused on optimizing the flow through the nodes in the network instead of optimizing complex chains. According to Gustafsson and Norrman (2001) the positive effects of the NMS-concept are: improved service levels, reduced administration- and inventory carrying costs. However, to experience positive results requires acceptance of the new concept, commitment from the actors involved and that organizational- as well as process changes are dealt with along the way (Gustafsson & Norrman, 2001).

3.4 Business renewal due to SCM

The fast development in communications and the use of the Internet have led to new possibilities where companies can be more responsive to their customers. With today's technology, a company can receive orders from the customer in real-time which improves the order processing and enables shorter cycle-times for orders. However, Williams et al. (2002) also states that this implies changes in the organizational structure since it changes the marketplace and affects the way how leaders should act. This is in line with the purpose of the thesis. Although we strive to go even deeper to be able to explain the consequences of the effects.

3.4.1 Different types of processes

Lind (2003) categorizes processes into three different groups. These are: providing-, fundamental- and delivery processes. Within each of these processes there are several specified sub-processes, which describes the activities on a more operational level.

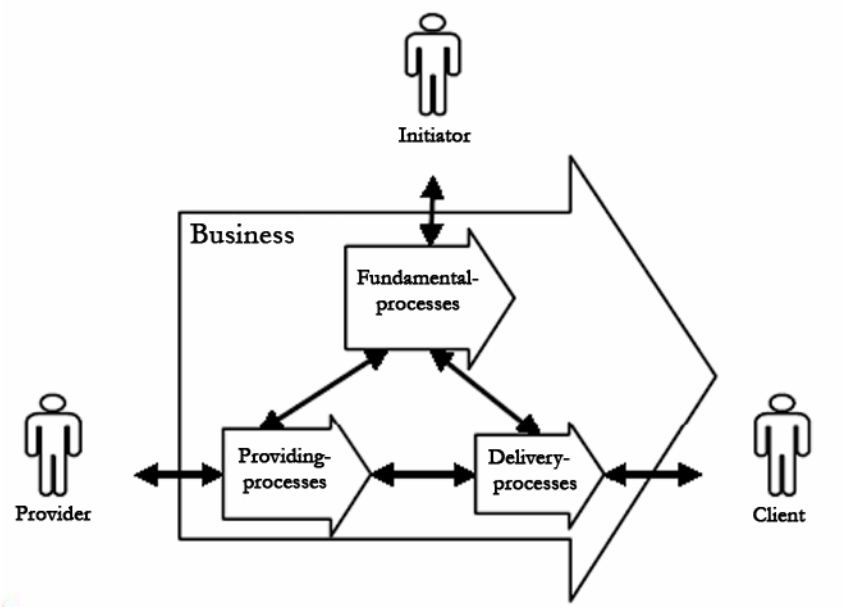

Figure 3.3 Typical processes in a business (Lind, 2003).

Providing processes covers the purchase activities and the replenishment of material. Delivery processes consists of order handling processes, sales processes and delivery processes. Fundamental processes are more of internal characteristic and covers production processes, administration processes and other management processes.

3.4.2 Business processes

A process can be defined as a sequence of activities which operates within the organization (Becker, Kugeler & Rosemann, 2003). Business processes deals with the execution of activities that exists through the whole organization and can be seen as special processes that is based upon the business objectives. Becker et al. (2003) further claim that activities can be divided into primary activities and supporting activities. This is presented in Porter's value chain, which is a model that gives a holistic view over all business activities within the organization. The main goal for all these activities, which the value chain focuses on, is to generate value. All business processes and their activities need to create value in the end. Therefore, it is important to always reflect on which of the processes that one could improve and how to manage the redesign in the best way (Becker et al., 2003).

Morecroft, Sanchez and Heene (2002) also talks about this and defines the term "management processes". Management processes refer to goal setting, decision making and coordination of activities. This is done by developing and deploying an organization's resources in order to create as much value as possible from the processes.

A focus on business processes has led to new organizational structures and IT-related solutions (Becker et al., 2003). IT developments have automated the execution of business processes throughout the whole organization. However, many of the IT-related solutions have failed because of weak integration with the company's existing business processes.

Therefore it is of great importance to identify and analyze the different process within the organization before an implementation of an IT-Logistics solution can be done (Becker et al., 2003).

Becker et al. (2003) further argue that business processes can be divided into core processes and supporting processes. Core processes are processes which activities directly relate to the company's products that create direct value from the customer's point of view. Supporting processes is on the other hand processes that do not create direct value for the customer but are necessary to have in order to execute the core processes. However, the boundaries between core- and supporting processes can be floating since the same process can be both, depending on the circumstances and the different context the process exists in (Becker et al., 2003).

Jahnukainen and Vepsäläinen (1992) do not categorize the processes as Becker et al. (2003) but discuss the significance of performing a process description before different business processes can be linked with an information system. A process description specifies the business activities and the required information between the business units. When this is specified, both communication tools and activities can better be integrated into the system. This makes the implementation of the system more integrated with existing processes and aligned with the business strategy (Jahnukainen & Vepsäläinen, 1992).

3.4.3 Strategies of SCM

In order to obtain an effective supply chain it is of great importance to set up an overall strategy. The supply chain strategy should directly support the company's business strategy and be aligned with other business processes (Cohen & Roussel, 2004).

Cohen and Roussel (2004) claim that there are four criteria that need to be met in order to have a good supply chain strategy. The supply chain strategy needs to be aligned with the business strategy, with customers' needs and with the market position of a company. The last criterion Cohen and Roussel (2004) point out is that the strategy should be adaptive since the market conditions constantly changes.

Changes within the strategy of SCM can create big advantages for the company. A new or modified strategy can for example reduce inventory levels and create better customer service (Cohen & Roussel, 2004). A decision that the company needs to take is if it should "produce to stock" or "make to order" since this influences the structure of the whole supply chain.

Cohen and Roussel (2004) further claim that it can be a key source of performance advantage to change the operation strategy. The service level can be improved and inventory levels can be reduced if the company "make to order" instead of "produce to stock" (Cohen & Roussel, 2004). New circumstances in the market require that companies manufacture and ship their products directly to the end market. This has resulted in small pack sizes, combined with local variants of products dedicated to a given market (Cohen & Roussel, 2004).

One could also decide to outsource parts of the supply chain. However, before outsourcing, careful consideration needs to be made to evaluate the risks and the impact it will have on the business. For example, new tools can be necessary to use in order to manage inventory across the extended supply chain (Cohen & Roussel, 2004). It is common to use a third party logistics provider which takes care of the logistics for a company.

'Most industries use third party logistics providers for transportation, customs, warehousing, and other value-added services, such as final packaging, configuration testing, software loading, and site installation.' (Cohen & Roussel, 2004, p. 16)

When an outsourcing strategy is implemented, it is important to ensure that all processes are highly integrated within the supply chain process. It is not enough to look at processes that directly affect the supply chain alone. Enterprise processes such as technology, product & service development, marketing & sales etc. need to be integrated within the overall supply chain process (Cohen & Roussel, 2004). Because the supply chain spans several companies these need to be integrated through a strategic alliance to create an effective supply chain.

3.5 Strategic alliances

A definition of a strategic alliance is an establishment of inter-organizational relations and collaborative behavior for a specific purpose (Love & Gunasekaran, 1999). Strategic alliances are set up in order to transfer knowledge and resources between involved partners. Love and Gunasekaran (1999) further claim that there is a need for inter-organizational relations in order to improve the performance and remain competitive. Strategic alliances with the company's customers and suppliers can improve the cost effectiveness, quality and create a long-term competitive advantage. This can be done through having an understanding of how learning alliances can be built up among the different organizations.

According to Love and Gunasekaran (1999), learning alliances are strategic partnerships that have a mutual understanding and reflective learning between supply chain partners. Love and Gunasekaran (1999) states that manufacturing organizations cannot achieve a long-term competitive advantage without a strategic alliance with other organizations. Today, when the market is highly fluctuating, it is difficult for companies to be self-sufficient and flexible to market changes in demand. Therefore it has been more important to build strategic alliances with other companies in order to handle the situation (Love & Gunasekaran, 1999). Strategic alliances can provide the ability of generating value for customers and not only the basis for commercial transactions. A key to improved customer satisfaction and for acquiring competitive advantage is the ability to form alliances with other organizations (Love & Gunasekaran, 1999).

Williams et al. (2002) is more or less sharing the ideas of Love and Gunasekaran (1999) and claim that alliances can easier be created by using information technology. IT goes beyond organizational boundaries and can provide integration opportunities for the organization. Therefore, an electronic supply chain can be seen as a facilitator for building alliances with other companies compared to traditional supply chains (Williams et al., 2002).

Williams et al. (2002) further claim that IT connects different actors within the supply chain when building alliances. IT constitutes more or less the foundation for the alliance and works as a common platform which the alliance can work upon (Williams et al., 2002). An alliance needs to be managed correctly in order to be successful. Collaboration between the partners can result in efficiency gains and create opportunities for the stakeholders within the alliance. However, the alliances can also be less successful and even constitute a risk for the organization since information sharing is intensively used.

Love and Gunasekaran (1999) agree with this and further claim that collaborative relations can reduce the complexity of the environment to gain more control over a fast changing market. On the other hand, a strong collaboration could cause dependencies for organizations and increase the complexity between them (Love & Gunasekaran, 1999).

According to Love and Gunasekaran (1999), a strong alliance can improve the organization's ability to learn and develop themselves to a greater degree than without an established alliance. This gives the organization the opportunity to stay updated on the market to better satisfy customer demand.

Love and Gunasekaran (1999) further argue that IT plays a significant role for improving inter-organizational relations. Information management systems can be used to improve the communication between the partners in the alliances. Long-term alliances can improve the effectiveness of the supply chain.

3.6 Organizational impact of an implementation

Ruppel (2004) argues for the alignment of technology and business with an implementation guided by specific business needs. By achieving this, the greatest advantages of supply chain technology can be achieved. IT-systems should meet the needs of the user and easily be integrated with other systems.

In order to fully understand and being able to perform an effective implementation of a supply chain technology, a thorough understanding of the current business processes and the impact this kind of tools will have on these processes after implementation is needed (Ruppel, 2004). Further, Ruppel (2004) discusses the need for different implementation approaches, mainly because these factors of alignment between technology and business processes varies from company to company and between different solutions.

3.6.1 Critical Success Factors

Chaharbaghi, Feurer, Wargin and Weber (2002) argue for an alignment of strategy, people, processes and information technology. A change needs to be assessed by first examining the strategic goals and then linking these to change objectives. These change objectives should be evaluated in terms of impact. The most critical changes should be selected (usually two to five) and form the basis for the critical success factors (CSF's). All the selected CSF's have to go right to achieve the desired change (Chaharbaghi et al., 2002). Also, potential obstacles that may interfere with the CSF's must be identified. The next step will be to formulate the key processes that are essential in achieving the change objectives. The information requirements of the business must be modeled and the interaction between business activities and information must be defined. The process/information view forms the basis for choosing the right enabling technology.

A survey by Tompkins Associates indicates that almost 53 percent of supply chain professionals are dissatisfied with the ROI of their supply chain tools while others claim that ROI is being overstated by vendors (Ruppel, 2004).

When a certain process will be configured it is necessary to evaluate the impact of potential changes (Chaharbaghi et al., 2002). If a process spans several business units with conflicting goals it is necessary to decide on how to compromise. Processes should be developed with a focus on changes that make a clear difference in the eyes of the customers (Chaharbaghi et al., 2002).

The structured framework for alignment which is described by Chaharbaghi et al. (2002) and implemented for example by Hewlett and Packard for increasing the level of transparency and to help reduce the redundancies. Flexibility should be a cornerstone when changing the way of working. Flexibility allows for rapid implementations when the competitive environment changes and new technology arises (Chaharbaghi et al., 2002).

3.6.2 Integration of business and IT

In order to understand the integration of a supply chain management system, the integration can be viewed in different stages. Berry (1999) discusses four stages; Baseline-, Functional-, Internal- and External integration.

Stage one, the baseline, aims at integrating the most primary functions of the supply chain management. It covers sales, planning, material control, etc. The second stage, functional integration focuses on the inward flow of goods. Companies apply a time-phased planning as materials requirements planning (MRP) within the distribution network. Stage three, internal integration, involves local integration of goods which are directly controlled by the company. This stage uses distribution requirements planning (DRP) systems integrated with an MRP system. The last stage, external integration, is the stage where full supply chain integration is achieved. This stage takes the supply chain management scope outside the organization to embrace their suppliers and customers. The focus changes from a more product oriented view to a more customer-oriented view. In this stage, the customer organization is in focus to understand the customer's products, culture and market. This ensures that all companies within the supply chain are adjusted to the common requirements (Berry, 1999).

In order to perform a successful integration of an IT-solution it is necessary to have a deep understanding of the business and the industry in which the business operates in (Rapp, 2002). This understanding can be reached by using Berry's (1999) four stages of integration. Rapp (2002) further argues for an integration of IT with the company's overall business strategy. IT must be well integrated with all the company's functions such as R&D, manufacturing and marketing.

Rapp (2002) states that successful firms have a strategic link between technology and the organization's market objectives. The IT-investment needs to correspond to the overall business strategy and fit with other investments that are aligned with the strategy. Personnel practices and technology need to be closely integrated with each other (Rapp, 2002). The personnel need to accept the new technology if the integration shall succeed.

Rapp (2002) discusses the concept of Totally Integrated Management (TIM). TIM links all segments within the business such as supply, production, distribution, and the service chain with IT. This gives the opportunity to make cost savings, fast deliveries and increased customer satisfaction. TIM gives the opportunity for a more efficient response to changes in demand as a result of IT's ability to coordinate orders and production in a better way as a network (Rapp, 2002). A supplier network can be built up by sharing information and by linking companies' IT-systems together. This requires investments and the willingness to share information with all stakeholders within the network. Using IT can enhance the commitment among the partners and simplify the information sharing among them (Rapp, 2002).

3.6.3 Implementation effects on the business

An implementation of a real time IT-Logistics solution gives many positive effects for a business. One major effect Boughton and Kehoe (2001) define is the lower inventory levels. This is also emphasized by Vollmann et al. (2005) that claim that the system makes the warehousing activities more effective and gives opportunities of reduced amounts of goods in stock. Vollmann et al. (2005) further claim that an implementation of real time system can reduce the need for ordering and forecasting.

Other effects with a real time system are an optimization of the flow between different actors (Moberg et al., 2002). Boughton and Kehoe (2001) also claim that customer service level will increase and a stronger collaboration can be reached. This positive affects leads to reduced costs in the long run and stronger integration between the business partners.

This point of view is also shared by Gustafsson and Norrman (2001) that define improved service levels, reduced administration- and inventory carrying costs as the major effects of an implementation of a real time system.

3.6.4 Consequences of IT on business processes

In the past, IT was considered more as a supporting tool than it is today. But with time, the technology has become more sophisticated and the usage has increased dramatically (Chan, 2000). Because of that, IT has got a major role and affects the business to a greater degree than before. IT can now be seen as a major change medium for organizations' processes (Chan, 2000).

Different IT-solutions affects the business in various ways (Lee, 2004). Many improvements of the business's processes can be done through well integrated IT-solutions. IT enables to improve the business processes and strengthen the business customer relationship management (Lee, 2004). In order to manage this, it is necessary to make some adjustment within the business. A strong interplay should exist between the IT-solution and the business processes which the solution should operate within. Therefore, it is crucial to always evaluate and analyze how the existing business processes will be redesigned. Business Process Redesign (BPR) is one key area where IT has a crucial role (Lee, 2004). Many firms have seen big advantages of integrating different IT-solutions into their core business processes (Lee, 2004).

Lee (2004) points out several companies that have reported significant productivity gains due to an efficient implementation of IT-solutions. To give an example of a company, Lee (2004) illustrates Caterpillar, which carried out a successful integration between IT and existing business processes within the company's inventory control system.

Chan (2000) shares Lee's (2004) view points and claims that IT has a significant role in business processes redesign and commands new procedures within the business. IT has a big impact on the organization and can work as an initiator, facilitator, or an enabler for the business, depending on the situation and how the technology will be applied (Chan, 2000). Depending on which of these roles IT takes, it will affect the business differently and a better understanding of the effects can be reached.

The relationships that are affected by the technological solutions are barriers that need to be dealt with to ensure success and not only the technical solutions. Companies that are thinking about improving their flow of goods and information through optimizing the supply chain needs to take on a broader view.

It is necessary to understand the impacts of the implementation of such enabling software solutions and realize the effects on the business processes (Ruppel, 2004).

IT affects the business in two major ways, on a operational- or strategic level. IT enable changes in the job routines on an operational level but can also lead to strategically changes such as organizational transformation (Chan, 2000). Today's IT-solutions can enable an organization to break old patterns and create new ways of working (Chan, 2000). Through reengineering of business processes with the help of IT, the company can implement innovative and radical changes.

3.6.5 Summary

In this section, chapter 3.6 will be summarized where effects, consequences and critical success factors will be highlighted as they are discussed in the literature.

Effects

Implementation of a real-time IT-Logistics solution could:

- Enhance the commitment among the partners and simplify the information sharing among them (Rapp, 2002)
- Lowering inventory levels (Boughton & Kehoe, 2001)
- Make the warehousing activities more effective (Vollmann et al., 2005)
- Reduce the need for ordering and forecasting (Vollmann et al., 2005)
- Optimizing the flow between different actors (Moberg et al., 2002)
- Increase customer service levels and collaboration which leads to cost reductions and a stronger integration in the long run (Boughton & Kehoe, 2001)
- Reduce administration- and inventory carrying costs (Gustafsson & Norrman, 2001)

Consequences

IT can now be seen as a major change medium for organizations' processes (Chan, 2000). IT has a big impact on the organization and can work as an initiator, facilitator, or an enabler for the business and will affect the business differently depending on the specific role it takes (Chan, 2000).

IT enables improvement of business processes as well as improving the customer relationship management (Lee, 2004).

It is necessary to have an understanding of the impact the implementation of enabling software solutions have and to realize the effects on the business processes (Ruppel, 2004).

Big advantages can be gained by integrating different IT-solutions into their core business processes (Lee, 2004).

IT enables changes in job routines but can also lead to strategically changes such as organizational transformation (Chan, 2000).

IT enables an organization to break old patterns and create new ways of working (Chan, 2000). Through reengineering of business processes with the help of IT the company can implement innovative and radical changes.

Lee (2004) points out several companies that have reported significant productivity gains due to an efficient implementation of IT-solutions and thereby integrating IT and business processes.

Critical Success Factors

To perform a successful integration of an IT-solution it is necessary to have a deep understanding of the business and the industry in which the business operates in (Rapp, 2002).

A thorough understanding of the business processes and evaluation of the impact the new technology will have on the processes after implementation is needed (Chaharbaghi et al., 2002; Ruppel, 2004).

Chaharbaghi et al. (2002) argue for an alignment of strategy, people, processes and information technology.

Integration of IT with the company's overall business strategy is essential (Rapp, 2002).

Acceptance of the new technology is vital for success (Rapp, 2002).

4 Empirical study

This chapter will present the empirical data collected from the case study of three interrelated companies. The overall structure of the chapter is based upon the interviews of each company. The focus of the empirical study is to describe and explain the effects for the business of an implementation of a real-time IT-Logistics solution as well as what consequences the implementation has had on the business processes. Related to this area of interest is to identify the critical success factors for carrying out an implementation. These areas will form the basis for representing each of the companies involved in the empirical study.

The empirical study is based on a case of three related business partners which constitutes three different perspectives; a system developer (PipeChain), a manufacturer (Volvo Powertrain in Skövde) and a subcontractor (Metallfabriken Ljunghäll). The PipeChain as a solution was chosen because it was considered a good representation of a real-time based procurement solution. The PipeChain solution was implemented at Volvo Powertrain, a major company which today connects 72 of their subcontractors to the system. Metallfabriken Ljunghäll AB was one of three subcontractors that was enrolled in the PipeChain pilot project from the beginning.

4.1 PipeChain

PipeChain develops, markets and supports the PipeChain software suite and is Scandinavia's most experienced supplier of VMI projects.

Håkan Jöne works as customer responsible for bigger customers such as Volvo and Ericsson and as project manager at PipeChain owned by MA-System. PipeChain has 20 employees and the entire group including MA-System, PipeChain and Consafe Logistics has around 200 employees, a turnover of 250 million SEK and has costumers all over the world. PipeChain AB has about 100 clients.

4.1.1 Supply Chain Management

Supply chains and networks are fundamental within the PipeChain concept. It is according to Jöne (Personal communication, 2005-05-12) a great potential for real-time based networks. Networks are given too little attention and concern in today's business which is going to change in the future where it will have a substantial role. This is evident because of outsourcing of production to low-cost producing countries such as China and Korea. This creates a need for a more network focused business as it becomes more global. Logistics will be the main facilitator in the future (H. Jöne, personal communication, 2005-05-12). The market for real-time based networks is expanding and should gain more attention in the nearby future.

The PipeChain solution

'You can't force down suppliers' prices any more, and you can't charge customers more. The greatest potential for saving today is co-operation between business partners.' (PipeChain conceptual leaflet, 2005, p. 8)

Per Grettve, MD PipeChain

PipeChain is a collaborative supply chain solution which creates stock reductions and supply chain automation. The solution makes the customers more competitive and increase customer profits by improving the supply chain (PipeChain conceptual leaflet, 2005). The greatest potential for future savings lies in the collaboration among business partners. The PipeChain solution is network oriented and aims at bringing customers, producers and suppliers together (H. Jöne, personal communication, 2005-05-12). The customers can all benefit by having PipeChain eliminating uncertainty in demand together with a high visibility in the supply chain (PipeChain conceptual leaflet, 2005). Business integration with the sharing of several different collaborative processes are possible through the PipeChain solution. It is possible to use PipeChain with only two business partners up to very complex supply networks.

The PipeChain solution focuses on optimizing the entire network through real-time information not just on internal process optimization. Rather, the solution is optimizing the flow between business partners (H. Jöne, personal communication, 2005-05-12). PipeChain makes it possible to integrate the entire material flow into one single automatic, demand-driven execution process. PipeChain handles both production- and distribution processes. Areas covered by PipeChain are Collaborative Demand Planning, Electronic Automated Orders, WebEDI, Extended VMI as well as Monitoring (PipeChain conceptual leaflet, 2005).

PipeChain makes it possible to integrate the entire supply chain all the way from raw material to the end customer (H. Jöne, personal communication, 2005-05-12). The solution ensures that the flow in the network is controlled, fast and transparent. Integrating PipeChain with ERP systems can make the processes fully automated. The PipeChain solution is placed on a separate server that easily can communicate with other PipeChain servers, assuring simplicity, quality and speed as well as a high level of security with separate firewalls. The information transferred between partners contains data such as orders, balances, actual sales, production plans, stock coverage time, advised deliveries, etc. (PipeChain conceptual leaflet, 2005). It is possible through the PipeChain interface for everyone to view the demand all the way down to the final customer.

The information collected downstream is also presented upstream. Market demand drives the flow at all levels in the network. Real-time information is rapidly available between all tiers in the network with all the critical processes executed in real-time. Both customer- and purchase orders are designed to be fully automated (H. Jöne, personal communication, 2005-05-12). In PipeChain, suppliers and customers have access to the same data, have the same screens, the same processes, same alerts and the same key performance indicators, regardless of ERP and operating systems (PipeChain conceptual leaflet, 2005). The user interface in PipeChain shows warning signals for all events that are out of the ordinary. This enables the actor to focus directly on the actual problems and proposed solutions. The Event Manager is a powerful tool which gives the ability to add own functionality to support and enhance the supply process. This means that it is not only possible to automate demand in the supply chain but also to automatically solve the problems when they occur (PipeChain conceptual leaflet, 2005).

In 1999, the first implementation of PipeChain was carried out. It was a pure real-time based VMI-concept initially. Ericsson was the biggest customer 1999 when PipeChain was initiated. Today the PipeChain solution includes orderflows etc. Today it is more in the form of a procurement system with monitoring functionality. It is a much broader system today.

The real-time thinking is essential for the PipeChain as a concept. PipeChain philosophy is to create networks with information exchanged in real-time (H. Jöne, personal communication, 2005-05-12).

With this real-time thinking, PipeChain claims that it is possible to be more successful than just focusing on optimizing internal processes at different actors in the network. The focus should be to look at the flow between these organizations (H. Jöne, personal communication, 2005-05-12).

4.1.2 Implementation effects on the business

According to Jöne (Personal communication, 2005-05-12) Common effects for the business for customers implementing PipeChain are:

- **Inventory reduction**

  Volvo counted on inventory reductions when they chose PipeChain as system developer.

- **Less administration**

  Reduced administration (30-40%), such as less telephone calls due to order-handling and follow-ups. Less administration also means less costs.

- **Increased service levels**

  Increased customer service levels (close to 100%) because of higher product availability from the customer side.

Additional effects depending on line of business are:

- **Lowering transportation costs**

  Reductions in transportation costs such as removal of unnecessary fast deliveries due to exceptional peaks in demand or changes.

- **Higher flexibility**

  Increased flexibility in production as machine usage better can be planned to be used in the most efficient way. However, flexibility in production requires high volumes.

- **Less waste**

  Reduced waste due to elimination of overproduction.

- **Better control**

  Better control of production related to less waste and overproduction.

The Volvo project

PipeChain sold the solution/interface to Volvo Powertrain for 4-5 years ago who included three subcontractors (including Ljunghäll) in a pilot-project. The pilot project at Volvo Powertrain was initiated in 2000 and involves about 70 subcontractors connected to PipeChain today.

For Volvo the main advantage with implementing PipeChain was the reduction of stock levels. Volvo searched on the market for solutions that were capable of lowering their amount of capital tied in stock when they came in contact with PipeChain. According to Jöne (Personal communication, 2005-05-12) the Volvo project can be seen as a good example of how this should be done, from pilot to full implementation. Volvo had implementation groups with clear responsibilities and packages towards suppliers, communicating a win-win relationship.Volvo stood for the costs for implementing the PipeChain interface at the subcontractors. Volvo gains a lot on this implementation since they have involved around 70 suppliers.

4.1.3 Implementation consequences on the business processes

The most important parts are that the business must change its way of working to get the implementation of PipeChain to work. Volvo Powertrain has managed this implementation very well. Volvo has treated this as a change project (H. Jöne, personal communication, 2005-05-12).

PipeChain always looks at the business processes in detail to see:

- What do they perform?
- What needs to change?
- Breakdown to transaction level - What information is sent between actors?

Volvo used PipeChain as a complement to what they already had in place. VMI in real-time was clearly a business opportunity.

4.1.4 Critical Success Factors

It is not the technical side according to Jöne (Personal communication, 2005-05-12) that is critical for succeeding with an implementation of the PipeChain solution. Rather, it is the internal processes and the partnership that decides the outcome of the implementation. These two factors are presented shortly below.

- **Internal processes**
  Which form the basis for the entire way of working. It is important that an overall understanding of the change is gained by all employees involved in the implementation of PipeChain. Internal processes are changing as a result of the implementation. It is therefore essential to deal with the question of why the company should do this?

- **Partnership**
  This is where the relation is built between the manufacturer and the subcontractor. An understanding of the need for change is vital, both to be able to sell the PipeChain as a concept to their customers and to be able to establish a two-way platform of knowledge regarding the system between these parts. An underlying understanding between the two parties (manufacturer-subcontractor) contact divisions must be present to get this to work. Also, the logistics departments of the manufacturer and subcontractor need to be on the same level for this to be successful.

4.2 Volvo Powertrain

Volvo Powertrain is one of the world's leading manufacturer of heavy diesel engines and transmissions. They operate in Sweden, France and the US and have customers all over the world. The company has 8 000 employees in total. Tomas Mörk is working with the production planning system and is manager of global process- and system development. Lena Breman is project manager and was in charge of the PipeChain rollout. Volvo Powertrain has implemented the supply module of the PipeChain solution. This is important to emphasize since the complete PipeChain solution could look different for different cases and situations.

4.2.1 Supply Chain Management

The supply chain management is a central part of Volvo Powertrain's organization. They see the supply chain as a vital part of the overall business processes that need to be considered in order to be competitive. The supply chain stands for a major part within the business and needs to be managed as effective and efficient as possible (T. Mörk, personal communication, 2005-05-16).

Volvo Powertrain uses the term supply chain only for describing the integration with their subcontractors. They do not include other parts of the business such as the demand side. Instead Volvo Powertrain uses the term "order to delivery process" to include the whole process from demand to purchasing (L. Breman, personal communication, 2005-05-16). For Volvo Powertrain, supply chain management is more about communicating the need to the suppliers and bringing home the material (T. Mörk, personal communication, 2005-05-16).

Volvo Powertrain sees supply chain management as a very complex thing to manage. There are many different processes that is need to be integrated in order to attain a good flow through the entire organization. There are a lot of aspects, both from Volvo Powertrain's view point and from their suppliers, that need to be considered and managed, in order to have a successful supply chain (T. Mörk, personal communication, 2005-05-16).

Because of this high complexity, Volvo Powertrain is very restrictive in buying new system externally from a system developer. Volvo Powertrain has a very good knowledge of supply chain management and builds foremost their systems by themself. However, they are constantly updated in terms of other solutions that may be better and more effective than their own systems (T. Mörk, personal communication, 2005-05-16).

Supply Chain Solution before

According to Breman (Personal communication, 2005-05-16) Volvo Powertrain started to look at a real-time IT-Logistics solution in 1999. Before that, Volvo Powertrain used MRP systems that were connected with EDI technology to their suppliers. They did several different pilot projects before the solution was implemented. Volvo started with one supplier and increased to four of their suppliers. Now, six years after the first pilot project, Volvo Powertrain has approximately seventy suppliers that uses the new PipeChain solution.

Supply Chain Solution today

Volvo Powertrain is using much of their "old solutions" that were used before the implementation of PipeChain. Volvo Powertrain sees PipeChain more as a complement to their own MRP system and uses PipeChain to build a platform towards their suppliers. PipeChain can be seen as an interface between Volvo Powertrain and its suppliers that is built upon EDI and gets the data from Volvo Powertrain's ERP system (T. Mörk, personal communication, 2005-05-16). The PipeChain solution is very adaptable to other systems. This was one of the key features that Volvo Powertrain liked most and they adjusted the solution just as they wanted it.

Breman claims (Personal communication, 2005-05-16) that PipeChain is not a complete solution by itself, it requires good sources of data to work on. All data that is displayed within the system needs to be accurate and based on the right production factors in order to make the PipeChain solution to work (L. Breman, personal communication, 2005-05-16). Mörk argues (Personal communication 2005-05-16) that it is important to have a well established structure of the business processes in order to receive benefits from PipeChain.

Volvo Powertrain's existing MRP system constitutes the basis for the supply chain solution. PipeChain can more be seen as a great tool that gives the opportunity to integrate the MRP system's data with Volvo Powertrain's suppliers. Volvo Powertrain uses PipeChain as an information channel towards their suppliers in order to display their real time demand. However, it is possible to use the PipeChain solution as a standalone system independent of existing systems such as MRP/ERP.

Through the PipeChain system the suppliers can view Volvo Powertrain's demand and adjust their production to that. This enables a better production planning for the suppliers, who can attain a more stable production flow.

Volvo Powertrain has an assembly planning with a short-term planning of two days. This gives the suppliers two days for exactly knowing Volvo Powertrain's demand. However, the supplier can with help of PipeChain view Volvo Powertrains predicted demand under a much longer period of time. This data come from Volvo Powertrain's central planning where Volvo Powertrain takes in all orders and then split the demand to different suppliers.

4.2.2 Integration between businesses using IT

Volvo Powertrain needs to rely on its suppliers. They open up much of their demand situation and production. This requires good relations between Volvo Powertrain and the suppliers in order to make this work. Mörk says (Personal communication 2005-05-16) that it is important to have a good structure of production processes in order to integrate business and IT. A good balance needs to be evident between number of orders and stock (T. Mörk, personal communication, 2005-05-16).

4.2.3 Implementation effects on the business

Breman (Personal communication, 2005-05-16) saw many positive effects with the implementation of the PipeChain solution. One positive aspect was the improvement of service levels. Volvo Powertrain can with the help of PipeChain improve their service and give more accurate information to their suppliers. The suppliers can then easier plan their own production to reach a better long-term planning. This leads to improvements when it comes to in-goods logistics.

Volvo Powertrain gets the right material at the right time from their suppliers. This leads to a more effective production for Volvo Powertrain with no disturbance within the production process. Volume changes in the production can easily be seen for both Volvo Powertrain and their suppliers. This leads to a greater understanding and a better collaboration between the supplier and Volvo Powertrain.

Another major benefit Breman mentions (Personal communication, 2005-05-16) is the decrease of disturbances in Volvo Powertrain's production. The production is not prevented by shortage of materials and parts that comes from suppliers. By implementing the PipeChain solution, the delivery accuracy increased to 99,6 percent.

The PipeChain solution also gives the opportunity of reducing inventory levels (L. Breman, personal communication, 2005-05-16). The PipeChain solution facilitates collaboration within the supply chain with quicker and effective information sharing as a consequence. This reduces the inventory levels for both Volvo Powertrain and their suppliers. Even the administration cost is reduced since all transactions is done automatically and transformed from the supplier to Volvo Powertrain.

The last major positive effect the PipeChain implementation had on Volvo Powertrain's business was the transparency regarding the information sharing (L. Breman, personal communication, 2005-05-16). Both Volvo Powertrain and its supplier are able to view each others information in a very open way. This reinforces the relation with the supplier and create a strong partnership. Volvo Powertrain can also see when the supplier performes any changes and vice versa.

Another positive aspect with the implementation of the PipeChain solution is the ability to reduce the "freeze-time" in the production planning. Before the implementation it was necessary to freeze the production planning seven days ahead, now, that is reduced down to two days. This gives the opportunity of easier planning and creates a steady production with no high peaks and downs (L. Breman, personal communication, 2005-05-16).

In the future, Volvo Powertrain strives to integrate their supplier network even more. Volvo Powertrain wants a completely integrated VMI where the subcontractors takes the full responsibility for the goods. Suppliers will be the owner of goods in stock at Volvo Powertrain. Volvo Powertrain just pay for the goods they consume in real time (T. Mörk, personal communication, 2005-05-16).

4.2.4 Implementation consequences on the business processes

A more effective production for Volvo Powertrain and elimination of disturbances within the production process has lead to a better flow in the production process. Today Volvo Powertrain receives the right material at the right time because of increased delivery accuracy from subcontractors through PipeChain (L. Breman, personal communication, 2005-05-16).

PipeChain is seen as a complement to existing MRP systems at Volvo Powertrain and as a very powerful interface. It is very easy to implement, independently from existing systems which makes PipeChain is easy to connect However, an implementation of PipeChain requires that the underlying work patterns are in line with the PipeChain concept of easy flow, just like water distribution. Volvo has performed this implementation very well, they have done it in the right order from the beginning.

The production planning formed the basis for the implementation of PipeChain which calculate different parameters that the entire information in PipeChain is based upon.

PipeChain led to overall stock reductions and lower levels of administration at Volvo Powertrain. This has also lead to consequences for the production process which is now more effective and efficient with minimized inventory holding along the way and through elimination of halts and errors in the production flow. Naturally, if Volvo is able to create a better production flow, this will lead to higher service levels at their customers. Lowering administration will of course change the way of working. Today, with PipeChain, all the information is given by the common interface and the responsibility taken by the subcontractor which make the order- and delivery process between Ljunghäll and Volvo more effective and efficient.

Telephone calls and the interpretation of data received are dramatically reduced between Volvo and subcontractors related to orders and control. The procurement today is fully automated through the PipeChain solution.

4.2.5 Critical Success Factors

Breman mention (Personal communication, 2005-05-16) that it is of great importance to inform and involve as many as possible in the implementation of a new system. Everyone needs to strive in the same direction and see the positive effects of the changes.

Another critical success factor that Mörk sees (Personal communication, 2005-05-16) is good planning. Before an implementation can be carried out it is of great importance to have a specified plan and a holistic view covering over all processes that may be affected by the implementation.

Mörk also emphasize (Personal communication, 2005-05-16) the importance to have faith towards the suppliers. Much information is displayed and need to be confidently used in order to build and maintain trust.

4.3 Metallfabriken Ljunghäll AB

Ljunghäll is one of the leading die-casting companies in Europe and has about 700 employees. The logistics manager for Ljunghäll is Anica Sonnerstig and she has worked for Ljunghäll for 5 years. She was one of the first that was involved in the implementation of PipeChain at Volvo Powertrain. Ljunghäll came in contact with PipeChain when Volvo Powertrain started their PipeChain project several years ago. Sonnerstig saw many possibilities with PipeChain and had a positive approach towards the changes that the PipeChain solution would create (Personal communication, 2005-05-10). Today Sonnerstig is responsible for the main planning of production and shipment of goods where PipeChain is the tool for controlling everything.

4.3.1 Supply Chain Management

Before PipeChain, Ljunghäll only used planning documents based on information from the customer as a tool to be able to provide the customers with goods. Based on the planning they produce and deliver that specific amount of goods. This created unstable stock-levels for both Ljunghäll and its customers.

Additionally to this, it was hard for Ljunghäll to view the actual stock-levels that for example Volvo Powertrain had and a lot of administrative work had to be done to clarify the current levels and how much more of each goods that were needed. From the start, there was no red thread in the supply chain but today, one can clearly see the complete flow of goods (A. Sonnerstig, personal communication, 2005-05-10).

PipeChain gives Sonnerstig the possibility to see, in real time, exactly what and how much each customer needs. By being able to do so she can prioritise available capacity and ensure that each customer gets the correct deliveries without complicated administration (A. Sonnerstig, personal communication, 2005-05-10). In this way, PipeChain affects the whole production- and delivery process for Ljunghäll.

PipeChain is a web-based interface between different actors with the possibility to see the flow of goods. PipeChain is used more or less as tool for realizing the Vendor Managed Inventory (VMI) concept.

With the use of PipeChain, Ljunghäll is now able to see the daily consumption of a certain article at Volvo Powertrain and its current stock-levels for that goods (A. Sonnerstig, personal communication, 2005-05-10). The data is updated every night through a batch job but it could run as a completely real-time system, but as it is today there is no need for it. By having this information, it is possible to optimize the flow all the way from raw material to the finished product at Volvo Powertrain. The main factor that makes this achievable is the fact that Ljunghäll has a maximum and a minimum stock-level of each goods (A. Sonnerstig, personal communication, 2005-05-10). As long as it stays between those levels, Sonnerstig could plan the production as she likes and therefore have a more efficient production and make sure that Volvo Powertrain always have parts for their production line. Sonnerstig (personal communication, 2005-05-10) did however add that the stock-levels is impossible to take away completely but it could be minimized and especially for those products that are expensive or requires a lot of storage space.

Today it is possible for Ljunghäll to have a 180 days view of the demand that Volvo Powertrain has for each goods. However, this data is only for planning purpose. The data are not accurate and are used only for having an overview what might come. Sonnerstig (Personal communication, 2005-05-10) did say that today's and tomorrows need is usually enough for planning their production. Today Sonnerstig is able to take decisions more quickly than before, based on the system's deadlines and other data.

4.3.2 Integration between businesses using IT

By implementing the PipeChain solution, the integration between the companies has increased significantly, especially for Ljunghälls customers which are using PipeChain. Their customers have now opened themselves up and are giving away a lot more information towards their suppliers. Of course Ljunghäll thinks this is a great feature but at the same time it requires more trust and faith from their customers. Therefore, Ljunghäll have to live up to this and show that they can handle this kind of responsibility. Sonnerstig (Personal communications, 2005-05-10) states that the responsibility is a good thing since it shows that the customers have faith and trust in them and she does not see any problem with handling the information given to them. In fact it is the information exchange between Ljunghäll and Volvo Powertrain which is the main advantage with PipeChain and not a disadvantage in any way according to Sonnerstig (Personal communication, 2005-05-10). However, this is a sensitive issue when dealing with customers.

Sonnerstig says that there are not many customers that are as happy and forward as Volvo Powertrain to give away information, even though Ljunghäll more or less could guarantee a lower stock-level and higher delivery accuracy to that customer (A. Sonnerstig, personal communication). Further on Sonnerstig (Personal communication, 2005-05-10) claims that a higher quality and better service is possibly to achieve because of greater information exchange.

The PipeChain project has according to Sonnerstig (Personal Communication, 2005-05-10) shown that there are advantages to be gained for both the customer and the supplier by working with supplier procurement in PipeChain. As Sonnerstig puts it 'It's really a win-win situation which has increased several factors significantly for both partners' (A. Sonnerstig, personal communication, 2005-05-10). Ljunghäll is looking forward to have more customers using PipeChain so they could become even more efficient and give other customers the great service PipeChain offers.

4.3.3 Implementation effects on the business

PipeChain has created a better view for the logistics manager and the rest of the production planners on what should be produced at what time. PipeChain was very easy to configure and to implement and took only a few days according to Sonnerstig (Personal communication, 2005-05-10). Volvo Powertrain is taking the costs for the updates and changes done to the PipeChain solution for all their suppliers. Other effects that Sonnerstig (Personal communication, 2005-05-10) could identify are:

- Less goods in stock which creates lower costs
- Better planned transportation and a decrease in the number of transports
- Less courier vans due to the fact that they got min and max levels for the goods
- Not as much administrative work, such as telephone calls to Volvo Powertrain regarding orders
- Higher effectiveness in the production flow
- A better relation with Volvo Powertrain due to higher customer service
- A higher delivery accuracy than before

4.3.4 Implementation consequences on the business processes

The consequences are affecting the way of how the work is conducted. Ljunghäll could see several factors that were affected in one way or another. These might not be considered as major consequences for the company but they are still very vital and have improved Ljunghäll in many ways.

The production process is more efficient since PipeChain have contributed with a smoother flow and less stock overall and between the different processes. It is easier for the production- or logistics managers to be able to see when overtime is necessary and when it is not. This is also due to the fact that it is easier to plan the production with PipeChain depending on the need from Volvo Powertrain.

The consequence of this is that one could now change and optimize the process by taking own decisions so it fits Volvo Powertrain's needs and the capacity that Ljunghäll has (A. Sonnerstig, personal communication, 2005-05-10).

Administrative work and the order-handling process has changed for Ljunghäll today because with PipeChain there are no issues of keeping track of what Volvo Powertrain did order. This reduces the need for making telephone calls which are only used for critical issues today. According to Sonnerstig (Personal communication, 2005-05-10) this also helped to improve the relation between Ljunghäll and Volvo Powertrain, since fewer telephone calls creates less irritation among among the partners.

Another aspect that PipeChain made possible is that Ljunghäll could identify when Volvo Powertrain has any major problems and critical levels of goods. Using PipeChain gives the opportunity to react faster to these problems than before (A. Sonnerstig, personal communication, 2005-05-10).

However, the business processes have not been redesigned when implementing PipeChain because planning and processes were good as they were (A. Sonnerstig, personal communication, 2005-05-10). Instead some of the processes have been optimized naturally after the implementation since many stages in the supply chain gets more efficient with the help of the PipeChain solution.

4.3.5 Critical Success Factors

For the supplier it could be difficult to identify the critical success factors for the reason that they are usually not the ones that select the PipeChain solution. However, some important factors that need to be fulfilled that Sonnerstig has acknowledged is to see the possibilities and benefits with the solution and not the problems (A. Sonnerstig, personal communication, 2005-05-10). Many suppliers believe that they are doing the customers work and that they are not gaining anything from it.

Another factor that is vital to consider, is to show the customer that you could handle the trust and faith given to you. This is not as easy as it sounds since it is a great responsibility taking care of the information from the customers and there are not so many customers that are willing to share this with the suppliers according to Sonnerstig (Personal communication, 2005-05-10).

Once the decision has been made it is vital to dedicate time to see how the solution could be used in the best way for the organisation. Since every company has different designs of the processes, one needs to see how the PipeChain solution fits with the own organisation and adapt it after that.

5 Analysis

This chapter will analyze and present the empirical findings. A comparison between the theoretical framework and the empirical study will be done by critically reviewing and interpreting the results from these chapters. Further, the structure of this chapter will be based upon the purpose of the thesis which includes the implementation effects and consequences on the business as well as identification of critical success factors.

5.1 Implementation effects on the business

The effects are the easiest factors to identify and measure for everyone involved. The consequences are much harder to identify and measure since this requires more time and investigation to find what impact the implementation has on the organization and its processes. One could easily see that the different actors have mentioned some effects that the PipeChain solution clearly created. When looking in the literature one is getting the same impression, that the effects with these kinds of solutions are quite easy to identify. The authors mention what effects and benefits such a solution could generate.

It becomes very interesting when comparing the literature and the respondents since one wants to find out if they all state the same effects regarding the solution. One major effect that every respondent brought up is inventory reduction. This is in line with the theory that Boughton and Kehoe (2001) mention. They claim that one major effect of implementing such system is lower inventory levels. However, each respondent have a slightly different view of how that inventory reduction affects the organization. Ljunghäll saw effects like being able to make the production and shipping more effective which created lower stocks, both for themselves in the production line and for Volvo Powertrain in the main storage. Vollmann et al. (2005) discussed this as well, where a real-time system could become more effective regarding the warehousing activities which led to lowered stock-levels.

Another aspect that Vollmann et al. (2005) brought up was that the need for ordering and forecasting could be reduced as well. This is something that both Volvo Powertrain and Ljunghäll did experience since each order could be more specific and changeable in a shorter notice than before. However, this was not a problem for Ljunghäll as a supplier, in fact, it was more or less the other way around according to Sonnerstig (Personal communication, 2005-05-10). Ljunghäll received fewer orders and could rely more on the system which is being updated every night with new data. This results in an easier plan for their production based on these numbers. Volvo Powertrain noticed that the information given to the supplier were easier to interpret with the PipeChain solution which contributed to more accurate deliveries from the suppliers (L. Breman, personal communication, 2005-05-16).

The delivery accuracy is one major effect that PipeChain brings up when trying to convince companies to implement the PipeChain solution. Having a delivery accuracy close to 100 percent is possible with the PipeChain solution (H. Jöne, personal communication, 2005-05-12). This is affirmed by Volvo Powertrain since Breman (Personal communication, 2005-05-16) said that it has been a decrease of disturbance in the production. The implementation of the PipeChain solution contributed with reaching delivery accuracy of 99,6 percent. This is possible since the production is not prevented by shortage of parts and materials from suppliers. Boughton and Kehoe (2001) did not mention any certain number of the delivery accuracy, only that the service level towards the customer will increase which also was supported by Gustafsson and Norrman (2001).

Another effect that was identified was that the administrative work was reduced quite significantly. This is also supported by Gustafsson and Norrman (2001) who state that the administrative costs could be reduced with the support of a real-time system. What one is not usually thinking of when hearing administrative work is that it really has an effect on other things as well. For example Sonnerstig (Personal communication, 2005-05-10) said that not only fewer calls were being made after the implementation but also that there was a more pleasant discussion (less irritation between them) nowadays. This is probably due to the fact that the telephone calls today are more concerning certain issues or problems and not in the form of repeated questions and complaints. It seemed like PipeChain was aware of this and therefore had this as an argument for implementing the solution.

Sonnerstig (Personal communication, 2005-05-10) brought up the fact that the implementation created more responsibility for Ljunghäll as a supplier. Further on she stated that this was one of the main issues where many people from Ljunghäll were negative to the implementation of a solution like PipeChain. Sonnerstig saw the opportunities instead of the problems PipeChain could offer to Ljunghäll, such as more flexibility and higher efficient production (A. Sonnerstig, personal communication, 2005-05-10). This could create an optimized flow in the production process and also all the way to the production at Volvo Powertrain. These effects are brought up by Moberg et al. (2002) as well, were a discussion if a real time system would optimize the flow between different actors or not. Chaharbaghi et al. (2002) also talks about this and claims that flexibility should be a cornerstone when changing the way of working. Chaharbaghi et al. (2002) further claim that flexibility allows for rapid implementations when the competitive environment changes and new technology arises.

Jöne (Personal communication, 2005-05-12) claims that the supplier needs to have large volumes for being able to have a great flexibility and a more efficient production. Otherwise the effect might not be as big in this certain area. A side-effect of this which Ljunghäll noticed was that the transportation costs went down since it was easier to plan the transports which minimized the amount of expensive courier vans (A. Sonnerstig, personal communication, 2005-05-10). This is mentioned by Paulsson et al. (2000) which claim that one of the most significant factors of IT development is reduced transportation costs. PipeChain also acknowledged this side-effect but stated that the reason for lower transportation costs was due to the lack of exceptional peaks in demand or changes from the customer and not so much because of supplier's flexibility (H. Jöne, personal communication, 2005-05-12).

All these effects are leading to a greater collaboration and a better relationships between the supplier and its customers. Both Volvo Powertrain and Ljunghäll are able to see each others information in a very open way which reinforces the relation with the supplier and builds a strong partnership. This is in accordance with Love and Gunasekaran (1999) arguments, that to be able to improve the performance and remain competitive there is a need for having an inter-organizational relation. Further on Love and Gunasekaran (1999) believe that manufacturing organizations are not able to achieve a competitive advantage in the long-term without having a strategic alliance with other organizations. The same conclusion is claimed by Williams et al. (2002) who say that an electronic supply chain can be seen as a facilitator for building strong alliances with other companies.

A few other effects that were mentioned were for example that PipeChain solution lead to less waste and overproduction (H. Jöne, personal communication, 2005-05-12). Volvo Powertrain had an effect that only they could see more or less. This was the ability to lower the "freeze-time" in their production planning.

This gave the opportunity to have a steady production with no high peaks and downs as well as easier planning (L. Breman, personal communication, 2005-05-16).

To summarize the major effects based upon both the literature and the respondents we identified these ones:

- Inventory reduction, for both supplier and customer
- Higher delivery accuracy
- Greater relationship between the suppliers and the customers
- Less administrative work for both parties
- Higher flexibility and at the same time more responsibility for the suppliers

5.2 Implementation consequences on the business processes

IT affects the business in two major ways. IT enables change in job routines on a more operational level, but can also lead to strategically changes such as organizational transformation (Chan, 2000). The consequences are not as evident as the effects of implementing a PipeChain solution. However, they are still vital for success but more difficult to grasp and deal with. Today's IT-solutions can enable an organization to break old patterns and create new ways of working (Chan, 2000). Through reengineering of business processes with the help of IT, a company can implement innovative and radical changes. Little previous research has been conducted to find the consequences of implementing a real-time procurement solution such as PipeChain.

The overall idea shared by all respondents is that an implementation of PipeChain must be anchored in the organization and thereby be reflected in the underlying work patterns. The business processes must support the idea of an easy flow guided by the real-time demand from the customer. Information exchange is probably the most evident effect that has dramatically improved in accuracy and availability through PipeChain. The PipeChain concept is network oriented, aimed at bringing customers and suppliers closer together which requires closer relationships and mutual trust. This type of commitment plays an essential role and has a direct impact on the business processes. All stakeholders need to be committed to the partnership and willing to make sacrifices to maintain a long-term relationship (Wu et al., 2004). IT-solutions will improve the integration among actors in the supply chain and make the business processes more effective. Wu et al. (2004) claims that this is achieved by reorganizing the processes and automating the information flow between the businesses involved.

According to Ruppel (2004), to manage the organizational culture and the relationships within the supply chain are as important as the software itself. The relationships that are affected by the technological solutions are barriers that need to be dealt with to ensure success, not only the software solutions. Companies that are thinking of improving their flow of goods and information through optimizing the supply chain need to take on a broader view. It is necessary to understand the impacts on the implementation of such enabling software solutions and realize the effects on the business processes (Ruppel, 2004).

The supply network must be supported by the organization implementing PipeChain for it to be successful. A common view-point by the respondents is that an understanding of the need for change must be evident from both parties and communicated in the entire organization before a rollout of PipeChain solution can take place. This is supported by Ruppel (2004) who claims that an understanding of change is an underlying factor for success when dealing with an implementation of supply chain software.

The overall goal with PipeChain could definitely be seen as linking B2B processes together to optimize the supply network and not just the internal processes. The procurement process could be seen as improved through increased effectiveness and efficiency as well as improved order- and delivery process between Ljunghäll and Volvo Powertrain. A strong interplay exists between the IT-solution and the business processes which the solution should operate within (Lee, 2004).

Probably the most evident consequence for the business involved in a PipeChain rollout is the better flow in production. The production process is made more effective and efficient through reducing inventory holdings at various points in the production chain as well as eliminating overproduction and minimize halts in production. This is in line with Helo and Szekely (2005) who claim that the typical goals for SCM are to increase the productivity through reduction of total inventory and the cycle time for orders. In order to fulfill these objectives, the company needs to optimize the business processes related to material handling, information processing and capital control (Helo & Szekely, 2005).

The entire supply chain becomes more transparent with the use of PipeChain. The delivery processes are made more effective and efficient with higher delivery accuracy as a consequence. Cost reductions are related to this in the form of eliminating unnecessary deliveries. Helo and Szekely (2005) also discuss this and claim that information sharing across organizational boundaries can result in cost reductions, since all parties better can manage their current resources for future needs.

Because the PipeChain interface was adjusted towards the customer needs to a large extent, the solution was more or less modified to fit with the business, not the other way around. However, as described, the PipeChain implementation had a lot of consequences on the business processes but it was rather minimized because of adjustments of the interface. But more importantly is to have the "flow thinking" implemented beforehand in production to be able to seize the opportunities that the PipeChain solution offers.

Adding new or supporting processes or removing already existing ones seems not to be necessary to get the implementation of PipeChain to work. Both Volvo Powertrain and Ljunghäll had already a very good flow in the production process which contributed to the clear effects when implementing PipeChain. Volvo Powertrain has performed the implementation of PipeChain very well and can be seen as a role model (H. Jöne, personal communication, 2005-05-12). The production planning formed the basis for the implementation of PipeChain which calculate different parameters that the data in PipeChain is based upon. However, rationalization of supporting processes such as administration was evident at both Volvo Powertrain and Ljunghäll. It seems to be more about modification of processes already in place than adding new or removing obsolete ones.

Boughton and Kehoe (2001) mean that the key to improved supply chain operations is not entirely based on efficient information transfer but also on timely information availability. The production planning is not substituted for real-time demand data, rather it is made more accurate. Volvo Powertrain used PipeChain as a complement to what they already had in place. Real-time VMI is clearly a business advantage for Volvo Powertrain.

In order to carry out an effective implementation of a supply chain technology, a thorough understanding of the current business processes and the impact this technology will have on the processes after implementation is needed (Ruppel, 2004). PipeChain always look at the business processes in detail to identify existing processes, what needs to change and what information is sent between the actors.

The procurement at both Ljunghäll and Volvo Powertrain is today fully automated through PipeChain. It is now possible for Ljunghäll to change and optimize the process by taking own decisions that fits Volvo Powertrain's needs and the capacity that Ljunghäll has (A. Sonnerstig, personal communication, 2005-05-10).

Another aspect that PipeChain made possible is that Ljunghäll could identify when Volvo Powertrain has any major problems or critical levels of goods. Using PipeChain gives the opportunity to react faster to these problems than before (A. Sonnerstig, personal communication, 2005-05-10).

5.3 Critical Success Factors

It is a big advantage to specify critical success factors before an implementation. The critical success factors can work as a guideline for how the implementation of a new solution should be managed. It also forces the company to reflect on the situation they are in and find factors that need to be dealt with in order to succeed with the an implementation. All of the respondents saw some critical success factors with the implementation of PipeChain. They thought it was important and necessary to reflect over the situation and indentify the factors that played a crucial role in the work of implementing a new solution.

The critical success factors from the respondents were a bit different, although they had some similarities. According to Jöne (Personal communication, 2005-05-12) it is not the technical side that is critical for succeeding with an implementation of PipeChain. These arguments can also be heard from Breman (Personal communication, 2005-05-16) which emphasize the involvement and to anchor the implementation within the organization and its existing business processes. Ruppel (2004) talks about this and claims that a change needs to be assessed by first looking at strategic goals and then link these goals to more technical aspects.

Jöne (Personal communication, 2005-05-12) sees two areas that need to be considered in order to manage a well established implementation. One of these are the importance of internal processes. It is important that an overall understanding is reached and that all employees are involved in an implementation of PipeChain. It is essential to know the reason for the implementation in order to find the critical success factors. These arguments is also emphasized by Sonnerstig (Personal communication, 2005-05-12) who mentioned the importance of dedicating time to really see how the solution should be used in the best way for the organisation and how it can improve the existing processes.

Sonnerstig (Personal communication, 2005-05-12) also argued for a well adjustable solution that can be adapted to the organisation's business processes without having to do any bigger changes. This philosophy is also shared by Volvo Powertrain which performed many changes of the PipeChain solution before it was implemented in their business processes. This is also brought up by Becker et al. (2003) who argues for the importance of reflecting on which of the processes that could be improved and how to manage the redesign in the best way.

This is also mentioned within the literature where Chaharbaghi et al. (2002) argued for the importance of evaluating the impact of potential changes before an implementation can be done. Ruppel (2004) also talked about this and mentioned the importance to specify information requirements from the system before it can be used.

Since the PipeChain solution is a concept that establishes a two-way platform it is of great importance that both actors take advantage from it. Jöne (Personal communication, 2005-05-12) defines one of the critical success factors as the underlying understanding between the two parties. The contact between the two parties need to be well established and at the same level in order to get it to work. This is also argued by Williams et al. (2002) who claim that IT connects different actors within the supply chain and build alliances. Love and Gunasekaran (1999) argue further that IT plays a significant role for improving inter-organizational relations and that it is a need for inter-organizational relations in order to improve the performance and remain competitive.

One critical success factor that all respondents agreed on was the belief that the importance of faith and trust to each other. Volvo Powertrain thinks the faith towards their suppliers is one of the biggest success factors. Trust is a key aspect to consider in order to implement this kind of solution. Everyone needs to take their responsibilities and work in the same direction in order to succeed with the concept. These arguments are agreed upon in the literature. Kwon and Suh (2005) state that both trust and commitment need to be present in a relation between the manufacturer and its suppliers. This is also discussed by Chaharbaghi (2002) which argues for an alignment of strategy, people, processes and information technology in order to reach commitment.

Volvo Powertrain also sees good planning as a critical success factor. It is important to do the right thing and do everything in right order. This requires good knowledge and long-term planning in order to see how everything is connected. When this holistic view has been reached the prerequisites can be specified and the implementation can be done easier.

The last critical success factor Volvo Powertrain argues for is the importance of having a flexible solution. The solution should be flexible towards the existing business processes and for new potential processes. This is also argued by Chaharbaghi et al. (2002) who claim that flexibility should be a cornerstone when changing the way of working. Flexibility gives many future opportunities and allows for rapid implementations when the competitive environment changes and new technology arises. Helo and Szekely (2005) agree to this and argue for flexible IT-solutions that easily can be interconnected and changeable when required.

6 Conclusions

The major findings that are related to our purpose will be presented in this chapter. The findings are based upon the analysis where certain factors, patterns and key concepts were identified. Each one of the major effects will be presented together with the consequences that effect causes on the business processes. Last in this chapter there will be a presentation of the critical success factors for obtaining a successful implementation of a real-time IT-Logistics solution.

Implementation effects and related consequences

The related consequences from the effects were identified by analyzing the evident effects by connecting them to a certain consequence. This was done by having a discussion where we listed all the effects and consequences that we had identified. Thereafter we tried to see the pattern of each effect and consequence and connect each consequence to one or more effects. The conclusion and result of this are presented below. We believe that we have reached a result which is easy to interpret and also valuable for companies who has or will implement a real-time IT-Logistics solution. This is because we have explained that a change is necessary when implementing a IT system to be able to reach the effects. Further, we present the main critical success factors which are fundamental for obtaining a successful implementation. To clarify, the supplier is the subcontractor and the customer is the manufacturer in this case.

The effects are presented in bold font followed by the related consequences to that specific effect. Most of the effects have many consequences which are listed without order of precedence.

Inventory Reduction

- Makes it possible to obtain a more accurate planning process.
- A more effective production process is required to handle the faster flow.
- Transportation flow (delivery process) are more constant and more efficient.

Higher Delivery Accuracy

- Fewer halts in the production flow which affect the production process and makes it more effective.
- Higher risk since the customer expects to have all the materials in time which creates a need for a different risk handling process and production planning process.
- Reduced lead-times (Production-time, Delivery-time).

Improved Relations

- A need for having a mutual trust and responsibility that affects the delivery process for the supplier.
- Requires more openness between the suppliers and customers due to integrated business to business (B2B) processes such as the order handling process as well as the delivery process.

Increased Flexibility

- Less courier-transports due to a better production planning process for the suppliers.
- Better machine usage and overtime work since the production planning process is more flexible.
- Decreased set-up time.

Higher Supplier Responsibility

- More of an opportunity for the supplier than a risk if the supplier seize these opportunities and handles this responsibility by adapting and possibly changing the current processes.
- The supplier could take own decisions for production because of the minimum and maximum levels which creates an efficient production process.
- More controlled and accurate production process for the supplier because they got the opportunity to view the true demand from the customer, not just based on a plan or specific order.

Increased Customer Service

- Higher product availability to the end customer due to effective B2B process integration.

Lower freeze-time for Volvo Powertrain

- The planning process at the customer could become more efficient depending on how it is structured before the actual implementation.
- Increased time-frames for the supplier since the customer have shortened their time for planning which could increase time to the supplier.

Better Information Exchange

- More accurate and timely information, more reliable input to order- and production processes.
- Better relations between the customer and supplier due to the fact that the order handling process is handled much more smoothly after the implementation.
- Security issues needs to be considered because so much sensitive information is being managed by the supplier instead of the customer.

Less Administration

- Reduced cycle-time for orders which improves the order-handling process for suppliers and the procurement process for customers.
- Less control/follow ups which leads to less telephone calls etc.

Critical Success Factors

- Understanding of change (Same level between partners).
- The solution selected should be related to the business need and strategic goals.
- Evaluating the impact on business processes before implementation.
- Choose an adjustable solution towards users business needs.
- Important that the business processes supports the real-time IT-Logistics solution so it is possible to handle a more constant and faster flow.
- Understanding of the opportunities involved in an implementation of a real-time IT-Logistics solution like flexibilities and improvements of existing processes.
- Attaining mutual trust, by having faith in the suppliers.
- Implementation of a real-time IT-Logistics solution requires a good production planning for calculating demand data (input to the system).
- Choose a flexible procurement solution that supports the organization.
- Holistic view by all involved parties (to avoid internal conflicts).

7 Concluding discussion

Based upon the experiences received after having conducted the research some criticism towards the method will be presented in this chapter. Reflections considering the result and what implications it has in a wider context will be given as well. Finally, we will try to identify new questions and problems that could lay as a foundation for further research within this area.

7.1 Method criticism

This chapter is created for presenting the criticism of the selected method procedure of this thesis. We will also discuss the outcome of the research based on the trustworthiness of the research in terms of validity and reliability.

We are very pleased with the outcome of this research, but like all studies there is always something that one could improve or do differently. Since real-time solutions for the supply chain is a relatively new area we had some difficulties finding theories that went deep enough. The literature we found did more or less present the different SCM concepts and its effects and not so much the consequences when implementing a real-time solution. However, this proved that our purpose and choice of research area was recognized and important to illuminate.

The research method used to fulfill our purpose was chosen based upon the complexity of the research questions. This complexity could be described by saying that the questions that were asked could not be answered with any easy explanation from the respondents. Further, it is hard to create an understanding of how companies conduct their operation and how they implemented the solution using a survey which is necessary for asking deep questions such as identifying the effects and its consequences.

We believe that a quantitative study would not be sufficient to reach such conclusions that we have been able to do with the qualitative study. Thus, a high internal validity has been reached according to ourselves due to the fact that the data has been presented from a more deeply and complete view. This research method has lead to a delimitation of the number of respondents compared to a quantitative study which could affect the external validity. However, the different perspectives (system developer, manufacturer and subcontractor) used in this thesis gives a broader view on the effects and consequences as well as the critical success factors which creates a greater external validity. To reach an even higher validity we should have used two cases instead of one and compared them with each other.

When it comes to reliability, we have tried to present our procedure and course of action as clear as possible. The interview guides are presented in the appendices (2-4) and in chapter 2.4.4, the design and procedure of the interviews. Maybe, to be critical here we ought to have followed our guides a bit more strictly during the interviews since the respondents easily talked freely about the solution and its effects without answering some of the direct questions from us. It might also be seen as a negative thing to hand out the guides before the interviews but it seemed that none of the respondents had prepared any answers for those questions anyway.

In general we believe that we have included theories, models and concepts that are related to the purpose of this thesis. We believe this has given the reader a better understanding, concerning the role of supply chain management within a company and what impact an implementation of a real-time IT-Logistics solution could have.

7.2 Reflections

The purpose of this thesis has been fulfilled and the knowledge goals have been reached since an understanding of the organizational impact when implementing a real-time IT-Logistics solution has been presented. A description of the effects on the business and an explanation of the related consequences when a real-time solution has been implemented are given.

The effects and consequences are discussed based on different perspectives as well as brought together to reach a conceptual understanding of the implications for the supply network. The implementation of real-time solutions for procurement creates a need for aligning B2B processes to reach collaboration with effective information exchange.

Based on the effects for the business and the related consequences, critical success factors have been generated for being able to experience the benefits of such real-time IT-Logistics solutions. Therefore the knowledge contributed are in line with the purpose and stated knowledge goals of the thesis.

An important reflection that was made when carrying out this research is that implementing a real-time IT-Logistics solution can yield great benefits for the organizations involved. However, this may only be possible if the actors involved have adjusted their business processes for being in line with this new real-time concept where the business and IT must be fully integrated. The biggest advantage and a prerequisite for success lies in optimizing the entire flow, including the production process to act upon real-time demand. It is necessary to optimize the flow between the different actors in the network, such as between the subcontractors and the manufacturer, not just internal optimization.

The changes caused by an implementation are more in the form of modification of existing processes, especially the production process, the order- (subcontractor) and procurement processes (manufacturer) and the delivery process. The improvements made are all in line with the flow-thinking of Networked Managed Supply.

The conclusions drawn by finding the effects and the related consequences to these effects and cross-relations as well as the critical success factors can be generalized. It is possible to generalize the findings since the case represented here is a good representation of a real-time implementation. Therefore the conclusions might correspond very well with other similar solutions and lines of businesses. There are great advantages to be gained by implementing real-time IT-Logistics solutions for procurement such as reduced inventory levels, reduced lead-times and improved deliver accuracy. Further, the production process can better be managed and controlled. Customer service levels will rise as a consequence. Clearly these kinds of solutions can be a source of competitive advantage which improves the collaboration between companies in the supply network.

7.3 Further research

This thesis has been based on a case study from three different actors point of view. The case study is done through a certain real-time logistics solution (PipeChain) that ties these different actors togheter. Further research could be to study other similar solutions with other actors, in order to get a deeper understanding and perhaps reach a more generalized result of effects and consequences when implementing a real-time IT-Logistics solution.

Since this thesis focus on effects and consequences of an implementation, further research could be to consider the modification of already existing systems within a business and identify effects and consequences related to that.

Another aspect that also could be considered is changes in different roles within the business. Questions as how the real-time solution can change different roles and responsibilities could be discussed in further research. We believe this is an interesting area to perform additional research within.

Further research could also be to identify differences in implementation-effects for different types of businesses. This additional research contributes to a deeper understanding and can be one step further in order to reach a higher degree of generalization.

7.4 Acknowledgement

We would like to thank the respondents and their companies for taking their time and helping us to make the thesis possible. Further, we would like to thank our tutor Ulf Seigerroth for the valuable feedback given.

References

AMR. (2004). *The SCM Application Spending Report*. Boston: AMR Research Inc.

Avgerou, C. (2000). Information systems: what sort of science is it?. *Omega – The International Journal of Management Science, Vol. 28*, 567-579.

Ballou, R. H. (2004). *Business Logistics/Supply Chain Management: planning, organizing, and controlling the supply chain*. New Jersey: Pearson.

Becker, J., Kugeler, M., & Rosemann, M. (2003). *Process Management – A Guide for the Design of Business Processes*. New York: Springer.

Berry, D. (1999). The BPR SCOPE concept in leveraging improved supply chain performance. *Business Process Management Journal, Vol. 5*(3), 254-274.

Björklund, M., & Paulsson, U. (2003). *Seminarieboken – att skriva, presentera och opponera*. Lund: Studentlitteratur.

Boughton, N., & Kehoe, D. (2001). Internet based supply chain management – A classification of approaches to manufacturing planning and control. *International Journal of Operations & Production Management, Vol. 21*(4), 516-524.

Bryman, A., & Burgess, R. G. (1999). *Qualitative Research (Vol. 1)*. London: SAGE Publications.

Chaharbaghi, K., Feurer, R., Wargin, J., & Weber, M. (2002). Aligning Strategies, Processes, and Information Technology: a Case Study. I Ayers, J. B. (Ed.), *Making Supply Chain Management Work. (p. 219-236). Boca Raton: CRC Press LLC.*

Chan, S. L. (2000). Information technology in business processes. *Business Process Management Journal, Vol. 6*(3), 224-237.

Cohen, S., & Roussel, J. (2004). *Strategic Supply chain management – The 5 disciplines for top performance*. New York: McGraw-Hill Professional.

Gartner Group. (2001). *Liquidity projections for B2B ecommerce by marketplace type*. UK: Gartner Inc.

Guneriussen, W. (1997*). Aktör, handling och struktur – Grundproblem i samhällsvetenskapen*. Lund: Studentlitteratur.

Gustafsson, J. & Norrman, A. (2001). *Network Managed Supply – Execution of Real Time Replenishment in Supply Networks*. Lund: MA-system AB.

Halvorsen, K. (1992). *Samhällsvetenskaplig metod*. Lund: Studentlitteratur.

Harrison, A., & van Hoek, R. (2002). *Logistics Management and Strategy*. Harlow: Prentice Hall.

Helo, P., & Szekely, B. (2005). Logistics information systems – An analysis of software solutions for supply chain co-ordination. *Industrial Management & Data Systems*, *Vol. 105*(1), 5-18.

Jahnukainen, M., & Vepsäläinen A. P. J. (1992). *Joining the Global Race – Redesign of Business Processes and Logistic Capabilities*. Helsinki: The System Group.

Kemppainen, K., & Vepsäläinen A. P. J. (2003). Trends in industrial supply chains and networks. *International Journal of Physical Distribution & Logistics Management, Vol. 33*(8), 701-719.

Kumar, R. (1999). *Research Methodology – A step-by-step guide for beginners*. London: SAGE Publications.

Kwon, I-W., & Suh, T. (2005). Trust, commitment and relationships in supply chain management: a path analysis. *Supply Chain Management: An International Journal. 10/1 2005*. 26-33.

Lee, I. (2004). Evaluating business process-integrated information technology investment. *Business Process Management Journal, Vol. 10*(2), 214-233.

Li, Z., Kumar, A., & Lim, Y. G. (2002). Supply chain modelling – a co-ordination approach. *Integrated Manufacturing Systems, 13/8,* 551-561.

Lind, M. (2003). *Lecture 2004 November 1st: Processorientering*. Retrieved 2005-04-28, from Jönköping International Business School's Website: http://jibsnet.hj.se/documents/files/6107549372960112671.pdf

Love, P. E. D, & Gunasekaran, A. (1999). Learning alliances: a customer-supplier focus for continious improvement in manufacturing. *Industrial & Commercial Training, Vol. 31*(3), 88-96.

Lundahl, U., & Skärvad, P-H. (1999). *Utredningsmetodik för samhällsvetare och ekonomer* (3rd ed.). Lund: Studentlitteratur.

Mark, R. (1996). *Research made simple – A handbook for social workers*. Thousands Oaks: SAGE Publications.

McLeod, R., & Schell, G. (2004). *Management Information Systems* (9th ed.). New Jersey: Pearson Education.

McMullan, A., (1996). Supply chain management practices in Asia Pacific today. *International Journal of Physical Distribution & Logistics Management. Vol. 26*(10), 79-95.

Mentzer, J. T. (2004). *Fundamentals of Supply Chain Management: twelve drivers of competitive advantage*. Knoxville: SAGE Publications.

Merriam, S. B. (1994). *Fallstudien som forskningsmetod*. Lund: Studentlitteratur.

Moberg, R. C., Cutler, D. B., Gross, A., & Speh, T. W. (2002). Identifying antecedents of information exchange within supply chains. *International Journal of Physical Distribution & Logistics Management, Vol. 32*(9), 755-770.

Molander, B. (2003). *Vetenskapsfilosofi – En bok om vetenskapen och den vetenskapande människan* (2nd ed.). Stockholm: Thales.

Morecroft, J., Sanchez, R., & Heene, A. (2002). *System Perspectives on Resources, Capabilities, and Management Processes.* Amsterdam: Pergamon.

Paulsson, U., & Nilsson, C-H., & Tryggestad, K. (2000). *Flödesekonomi – Supply Chain Management*. Lund: Studentlitteratur.

PipeChain. (2005). *PipeChain - A system that automates the supply chain between customers and suppliers* [PipeChain conceptual leaflet]. Lund: PipeChain Inc.

Rapp, W. V. (2002). *Information Technology Strategies – How Leading Firms Use IT to Gain an Advantage.* New York: Oxford University Press.

Repstad, P. (1999). *Närhet och distans – Kvalitativa metoder i samhällsvetenskap* (3rd ed.). Lund: Studentlitteratur.

Ruppel, C. (2004). An information systems perspective of supply chain tool compatibility: the roles of technology fit and relationships. *Business Process Management Journal, Vol. 10*(3), 311-324.

Vollmann, T. E., & Berry, W. L., & Whybark, C. D., & Jacobs R. F. (2005). *Manufacturing Planning and Control Systems for Supply Chain Management* (5th ed.). New York: McGraw-Hill.

Wigblad, R. (1997). *Karta över vetenskapliga samband: Orientering i den samhällsvetenskapliga metoddjungeln* (2nd ed.). Lund: Studentlitteratur.

Williams, R. L., & Esper, L. T., & Ozment, J. (2002). The electronic supply chain: Its impact on the current and future structure of strategic alliances, partnerships and logistics leadership. *International Journal of Physical Distribution & Logistics Management, Vol. 32*(8), 703-719.

Wu, W-Y., Chiag, C-Y., Wu, Y-J., & Tu, H-J. (2004). The influencing factors of commitment and business integration on supply chain management. *Industrial Management & Data Systems. Vol. 104,* 322-333.

Appendix 1 - Definitions

Business to Business (B2B) processes: We define B2B as businesses that sells products or provides services to other businesses and B2B processes as processes that connect their businesses.

Information Technology (IT): Information Technology (IT) or Information and Communication Technology (ICT) are a relatively broad term referring to the technology required for information processing. This means to convert, store, protect, process, transmit and retrieve information from anywhere, anytime. The term IT or ICT are used interchangeably and especially when referring to electronic computers and software. The term IT will be used in this thesis when referring to this kind of technology.

Information system (IS): Information systems exists in various forms but has the overall goal of supporting the business with valuable information through some type of interface connected to a database. Information system is a narrower term than IT, focusing on business systems that process, stores data, that transmit and retrieve data from other systems or applications.

IT-Logistics: This term in this thesis refers to the use of IT-systems for information exchange when dealing with logistics (Supply Chain Management).

Logistics: Refers to the flow of material and information between companies included in a network of buyer-supplier relationships.

Network: A network includes all the linkages between companies that have some kind of connection to each other. Network is a better term to use than supply chains when dealing with high levels of complexity where the number of actors involved are huge and the interconnections between those actors are cross-linked. Network and Supply Network will be used interchangeably.

Pipeline: The word pipeline is used as a metaphor for describing the supply chain. It can be viewed as water flowing through a pipeline between the supplier and the customer where the water is representing the flow of goods and information. Pipeline will be used as a synonym for the supply chain throughout this thesis.

Process: A process refers to a set of activities not constrained by departmental boundaries. Process thinking is a more dynamic form of describing organizational behavior and change compared to static units or departments. An example could be the *sales process* which spans several departments such as sales, marketing and R&D.

Procurement: Procurement could be seen as the entire process from order handling to automated replenishment based on the production demand. Procurement will be used when referring to real-time IT-Logistics solutions, mainly because of the underlying philosophy of minimizing inventory.

Real-time: The meaning of real-time is that of an event that occurs instantly with minimum delay, that is, occurs at present point in time. When referring to real-time in the case of this thesis, the focus is towards real-time information exchange, including such things as customer demand data etc. being transferred instantly.

Real-time IT-Logistics solutions: In line with the purpose of this thesis, real-time IT-Logistics solutions, are information systems aimed at linking together buyer-supplier within the same network. The focus of these systems are to transfer information on customer demand instantly (in real-time) together with integrated warehouse information on actual stock levels etc. The main goal of such systems is to improve the logistics (supply chain) through reduced inventory and increased agility of manufacturing.

Replenishment: Replenishment refers to the automated "fill-up" concept to stock. This definition is often used when discussing VMI.

Solution: A solution in this case is a technical solution such as system. By "*system*" in this thesis we mean an *information system* with the intent to support the supply chain.

Supply Chain (SC): The supply chain is linking companies together with established buyer-supplier relationships. Through the chain, goods and information are transferred between the different actors. When complex interlinkages exist this is referred to as a *Network*.

Supply Chain Management (SCM): Management of supply chains is similar to the concept of logistics management and tends to be treated as the same concepts today. Generally SCM is more concerned with the strategic level, such as establishing partnerships and building linkages between marketing and logistics, while logistics tend to be more focused on the operational flow of goods and information. In this thesis the two concepts of logistics and SCM will be treated as similar concepts. However, when referring to IT-Logistics we have the distribution of material and information in focus. At the same time, IT-Logistics could be seen as an enabler of partnerships and therefore has a lot of SCM characteristics.

Supply Network: See *Network*.

System: A system is a group of interdependent items that interact regularly to perform a specific task.

Vendor Managed Inventory (VMI): The VMI concept is used for outsourcing the replenishment process with the goal of reducing inventory levels. The supplier takes on the full responsibility for the replenishment.

Appendix 2 – Interview Guide PipeChain

INTERNATIONELLA HANDELSHÖGSKOLAN

Daniel Abdiu
Mikael Strandberg
Martin Stridsberg
Dataekonomiska programmet

PipeChain
Håkan Jöne

Topics and a selection of questions from the complete interview

Opening

Your current position, tasks etc.?

What is your view of the supply chain and its Network?

- What kind of influence does it have on a company?
- In which way have the supply chain concept been changed over time? (bigger or less influence?)

What kind of significance has the integration between companies according to you?

What are the critical issues that one need to consider to be successful in integrating companies?

Logistic solution (PipeChain)

Overall explanation of the PipeChain solution?

- How does the real-time solution work?
- Design etc.?

Why should one change the logistics system to the PipeChain (real-time)?

What is the main reason for implementing a PipeChain solution?

Effects and consequences

Comparison between PipeChain and customer's (ex. Ljunghäll, Volvo) earlier system?

Any known problems with the earlier system?

Why change to a real-time system?

What effects does PipeChain contribute with?

How do you analyze the customers processes?

What kind of adaptment of the business is necessary for the customer?

What consequences are generated by the change to your system regarding business processes?

Conclusion

Do you consider the implementation regarding Ljunghäll and Volvo a success?

What critical sucess factors (CSF's) do you see as necessary for a successful implementation? – Why?

Future possibilities for improvements and new functions in the system?

- Development of the business / system?

Further comments and corrections

Appendix 3 – Interview Guide Volvo Powertrain

INTERNATIONELLA HANDELSHÖGSKOLAN

Daniel Abdiu
Mikael Strandberg
Martin Stridsberg
Dataekonomiska programmet

Volvo Powertrain
Tomas Mörk, Lena Breman

Topics and a selection of questions from the complete interview

Opening

Your current position, tasks etc.?

What is your view of the supply chain and its Network?

- What kind of influence does it have on a company?
- In which way have the supply chain concept been changed over time? (bigger or less influence?)
- What is your view on the integration between you and your partners/subcontractors?

Logistics solution (PipeChain)

Overall explanation of the current (PipeChain) solution?

Earlier system / Structure of the system?

What was the reason for changing to a new logistics solution?

Was there any problems with the last system/structure?

What was the purpose with the implementation of the PipeChain solution?

What attributes/functions did you expect from the system?

Could you explain the company's SCM strategy? (Long- / Short term)

What effects on the business did the system cause?

Description of the processes, what business proceses are affected by the new system?

What consequences are generated by the change to the PipeChain system regarding business processes?

Conclusion

Are you satisfied with the new system?

Any known problems?

What critical sucess factors (CSF's) do you see as necessary for a successful implementation? – Why?

Any desirable future improvements and functions in the system?

- Development of the business / system?

Further comments and corrections

Appendix 4 – Interview Guide Metallfabriken Ljunghäll

INTERNATIONELLA HANDELSHÖGSKOLAN

Daniel Abdiu
Mikael Strandberg
Martin Stridsberg
Dataekonomiska programmet

Metallfabriken Ljunghäll
Anica Sonnerstig

Topics and a selection of questions from the complete interview

Opening

Your current position, tasks etc.?

What is your view of the supply chain and its Network?

- What kind of influence does it have on a company?
- In which way have the supply chain concept been changed over time? (bigger or less influence?)
- What is your view on the integration between you and your partners?

Logistics solution (PipeChain)

Overall explanation of the current (PipeChain) solution?

Earlier system / Structure of the system?

What was the reason for changing to a new logistics solution?

Was there any problems with the last system/structure?

What was the purpose with the implementation of the PipeChain solution?

- Business utility?

What attributes/functions did you expect from the system?

Could you explain the company's SCM strategy? (Long- / Short term)

What effects on the business did the system cause?

Description of the processes, what business proceses are affected by the new system?

What consequences are generated by the change to the PipeChain system regarding business processes?

Conclusion

Any known problems?

What critical sucess factors (CSF's) do you see as necessary for a successful implementation? – Why?

Any desirable future improvements and functions in the system?

- Development of the business / system?

Further comments and corrections