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Applying Supply Chain Visibility

A study at a company in the paper and pulp industry

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Preface

This thesis has been written during the autumn of 2010 and is the final part of our Master's degree in Industrial Engineering and Management at Lund Institute of Technology. The work with the thesis has sometimes been challenging but it has also given us valuable experiences and knowledge which we most certainly will find very useful in our professional careers.

The thesis has been made possible through the initiative of our sponsor Udo Lück to whom we express our gratitude. We would like to thank him for showing interest and giving guidance and feedback to our work. We would of course also like to thank our supervisor Fredrik Eng Larsson at Lund University for giving us feedback and helping us in the process. Additionally we would also like to send a special thanks to Jörgen Andersson for helping us with all the practical details and providing us with office facilities. A special thanks also to Sanna Keinänen for providing us with material and always being very helpful.

Without our interviewees taking their time and answering our questions, this study would not have been possible; we therefore would like to thank them all.

Lund, February 2011

Filip Adielsson Erik Gustavsson

Abstract

Title:	Applying Supply Chain Visibility – A study at a company in the paper and pulp industry
Authors:	Filip Adielsson and Erik Gustavsson
Supervisors:	Fredrik Eng Larsson - *PhD Candidate, Department of Industrial Management and Logistics, Engineering Logistics, Lund Institute of Technology, Lund University*
Sponsor:	Udo Lück
Background:	Companies are operating in a more global environment than before with larger flows of information. The information must be visualized and used in the right way in order for the supply chain to be efficient. If the companies can make relevant information available in an effective way they will have a more efficient supply chain and lower costs.
Purpose:	The purpose of this thesis is to find out how the investigated company's warehousing problems can be reduced by applying supply chain visibility and related concepts.
Objectives:	The objectives of the thesis are to give the company recommended solutions on how to reduce the warehousing problems by increased visibility in the supply chain and also to estimate the impact of these solutions.
Method:	This study has been done using a systems approach. Through an extensive literature review an analysis model combing theories of supply chain visibility and related concepts was developed. The model was applied in the case studies at the company in order to find areas of improvement in the information sharing, which can lead to decreased inventory levels.

Conclusions: The study has showed that the information sharing is working relatively well at the company and they have quite good visibility in the supply chain. It can be concluded though, that increased visibility can help reduce the inventory levels. However, the factors affecting the inventory levels are very complex and it has been found information sharing is just one small part of the process. The main thing that needs to be improved is the managerial support on collaboration in order to establish routines and schedule regular meetings which enable a more efficient information sharing.

Keywords: Supply chain, supply chain management, information sharing, supply chain visibility, reduced inventory levels, paper and pulp industry

Sammanfattning

Titel:	Tillämpning av Supply Chain Visibility – en studie på ett företag i pappers och massaindustrin
Författare:	Filip Adielsson och Erik Gustavsson
Handledare:	Fredrik Eng Larsson – *Doktorand, Avdelningen för Teknisk Logistik, Lunds Tekniska Högskola, Lunds Universitet*
Förslagsställare:	Udo Lück
Bakgrund:	Företag verkar i en mer global miljö än tidigare med större informationsflöden. Informationen måste synliggöras och användas på rätt sätt för att försörjningskedjan skall bli effektiv. Om företagen kan göra rätt information tillgänglig på ett bra sätt kommer de att få en effektiv försörjningskedja och därmed lägre kostnader.
Syfte:	Syftet med studien är att se om man kan lösa företagets lagerproblem genom att tillämpa Suplly Chain Visibility och relaterade koncept.
Mål:	Målet med studien är att ge företaget rekommendationer på hur man skulle kunna lösa lagerproblemen genom Supply Chain Visibility och också uppskatta konsekvenskerna av de rekommenderade lösningarna.
Metod:	I studien har ett systemangreppssätt använts. Genom en omfattande litteraturstudie utvecklades en analysmodell som kombinerade teorierna kring Supply Chain Visibility och anknytande koncept. Modellen användes sedan i fallstudier hos företaget för att finna de förbättringsområden i informationsdelningen vilka skulle kunna minska lagernivåerna.
Slutsatser:	Slutsatserna från studien är att informationsdelningen i nuläget fungerar relativt bra. Studien har dock ändå funnit bevis på att

bättre visibilitet i försörjningskedlan kan hjälpa till att minska lagernivåerna. Dock är det många olika faktorer som påverkar lagernivåerna vilket gör situationen mycket komplex och informationsdelning blir därmed bara en liten del i att minska lagernivåerna. Det som främst måste förbättras är stödet från ledningen gällande informationsdelning och detta genom införande att bättre rutiner och återkommande möten vilket möjliggör en effektiv informationsdelning.

Nyckelord: Supply chain, supply chain management, information sharing, supply chain visibility, reduced inventory levels, paper and pulp industry

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1 Introduction

This chapter presents the background, purpose and objectives with the thesis. Some specific research questions will also be presented as well as focus and delimitations. The chapter concludes with a brief summary of the disposition of the report and the terminology used will be explained.

1.1 Background

Global companies are operating in a continuously faster changing environment. The supply chains are becoming more global with more actors involved which lead to more activities and larger flows of information. A challenge for the companies is to sort out relevant information and to make it available for the actors concerned. Also, if the information is not selected, managed and interpreted in the right way, variations and uncertainty in the supply chain may arise. If the companies on the other hand can make relevant information available in an effective way they will have a more efficient supply chain and lower costs. (Siems, 2005)

To cope with these new challenges, the concept of supply chain visibility has grown and become popular. According to a study by Mahadevan (2010) supply chain management professionals rate increasing supply chain visibility as the most important challenge they are facing today. Xiao-Feng & Yu (2009) states the following about the concept:

> "Many researchers who have approached the issue have proved that increased visibility will improve the performance of the supply chain." *(Xiao-Feng & Yu, 2009, p. 2)*

Since the concept is relatively new it is difficult to find a general definition. Goh *et al.* (2009) have tried to come up with a definition based on how the concept is used in practice and on the existing definitions in the literature. Their proposed definition reveals that the concept has very much to do with the ability to access or provide relevant information within the supply chain. Through this, increased supply chain visibility can lead to for example improved responsiveness, improved planning and replenishment capabilities and improved decision making. (Barrat & Oke, 2007)

The investigated company (hereafter "The company") is a global company in the paper, packaging and wood products industry. The company annually produce about 13 million tons paper. These figures give an idea that there are very large volumes handled in the supply chain. There are also many departments and people involved before a finished product reaches the final customer which further adds to the complexity. This has led to the company struggling with warehousing problems. The company experience they have too high inventory levels, too many warehouses and are suffering from left-over stock piling up at several locations. Although, since it is a huge company with many different products and markets, the extent to which these problems appear varies a lot. Also, new customers and markets are constantly acquired. Therefore there is not only a need for tools and procedures for correcting the current warehousing problems but also for continuously identifying and coping with them as they arise.

To deal with these problems the company has initiated an investigation of supply chain visibility. The amount of information regarding transports, sales, customers and inventory is enormous but most of it can be found in the same ERP-system. The company believes that this information can be used more

efficiently in order to deal with the warehousing problems, meaning that the right information is provided to the right people at the right time.

1.2 Purpose and objectives

The purpose of this thesis is to find out how the company's warehousing problems can be reduced by applying supply chain visibility and related concepts. The objectives are:

- To give the company recommended solutions on how to reduce the warehousing problems by increased visibility in the supply chain.
- To estimate the impact of these solutions.

1.3 Research questions

As mentioned above there is a lot of information in the company's ERP-system and they believe that if this information is used in a more efficient way the performance of the supply chain could be increased. With the warehousing problems along with the concept of supply chain visibility in mind, the authors will try to answer the following questions:

- Where in the sales process are the problems created?
    - Why here?
- To what extent can the problems be reduced by increased visibility?
    - What information is needed?
    - What organisational changes are needed?
    - Is there a need for any new software tools?
- What will the impact of increased visibility be?

1.4 Focus and delimitations

The company is handling different forest and paper products including wood products. The wood products differ from the other products in terms of product characteristics and are part of a completely different industry and are therefore excluded from this thesis. The authors are aware that the other three business areas also have their differences but will investigate them all and try to find generalizations.

While the three business areas investigated all have similar sales organisation in Europe, it looks a bit different in the rest of the world. It is also mainly in Europe that warehouses are used. Thus, the thesis will be limited to Europe.

The thesis will only focus on the warehousing problems and only look at supply chain visibility and closely related concepts as part of the solutions. The people interviewed will all be part of the sales process since it is in this process bad information sharing might affect the inventory levels.

The thesis will use an intra-firm perspective which means only departments and functions within the company group will be investigated. However, this does not exclude investigating if the supply chain would benefit from external data as well in their process. The main reason for this delimitation is due to the limited time and resources available for the thesis.

1.5 Disposition

Below a short summary of the contents of each chapter can be found.

Chapter 1: Introduction

In this chapter the background, purpose and objectives with the thesis will be discussed. It also contains some research questions, focus and delimitations, disposition and terminology.

Chapter 2: Methodology

This chapter describes the methodology used in this thesis as well as common methodological issues. This includes for example scientific approach, research methods and research design. Methods for data collection and analysis are also discussed as well as different quality criteria.

Chapter 3: Company description

Here a short summary of the company is given. Short facts are presented as well as a more detailed description of the company structure.

Chapter 4: Frame of reference

In this chapter a theoretical framework is presented. This framework was used to develop a model for analysis which also will be presented. Propositions for the case studies will also be discussed in this chapter.

Chapter 5: Empirical findings

In this chapter the findings from the data collection is summarized. The three case studies are presented separately along with some general findings.

Chapter 6: Case results and analysis

In this chapter the findings regarding information sharing in each case is presented and discussed. The chapter concludes with a cross-case analysis where differences and similarities between the cases are discussed and analysed.

Chapter 7: Summary

This chapter will summarizes the findings from the previous chapter and gives recommendations on how to improve on the mentioned areas. The chapter concludes with an evaluation of the study and recommendations on further research.

1.6 Terminology and abbreviations

BA is short for business area.

BU is short for business unit.

CSC is short for Customer Service Center which is the department in contact with the customers.

Quota is a ration set by the mills of how many tons each market can order. It can be set either monthly or weekly.

The term *route* includes both mean of transportation and the actual geographical route.

A *supply chain* will in this thesis start at one of the company's production sites and end at one of their customers.

Supply chain visibility is a concept with various definitions. We have chosen the following definition by Goh *et al.* (2009):

> *"Supply chain visibility is the capability of a supply chain player to have access to or to provide the required timely information/knowledge about the entities involved in the supply chain from/to relevant supply chain partners for better decision support." (Goh et al., 2009, p. 2549)*

For a more detailed review of the definition, see section 4.1.

2 Methodology

This chapter describes the methodology used in this thesis as well as common methodological issues. Each section concludes with a discussion about why certain methods and approaches are preferable to use in this thesis. The purpose of this is to ensure a high level of credibility.

When conducting a study it is of great importance to put effort into choosing the seemingly most relevant and appropriate methods and working procedures. By doing so, there is a far better chance that the purpose of the study is being fulfilled. The methods must be consistent and consequent in order for the results to be relevant. One should also have in mind that testing for the most suitable methods for solving a specific problem can never be done in advance. Instead the properties of each method can be investigated and compared and the methodology evaluated after the study is complete. (Arbnor & Bjerke, 1994, pp. 21-28)

2.1 Paradigms

When discussing methodology, the term *paradigm* is important. It was given its contemporary meaning by Thomas S Kuhn in his book: *The structure of Scientific Revolutions.* Two major paradigms relevant to this particular thesis will be discussed.

The term paradigm describes the bridge between the basic assumptions of the researcher and the methodology. Basic assumptions mean a person's views and values of the surrounding world and are according to Arbnor & Bjerke (1994) of a more philosophical art. These assumptions are formed to a large extent by the current and local cultural and academic circumstances in which the research team is active and constitutes a paradigm in which the scientific

work is performed. It is vital to understand the researcher's paradigm because this affects how they look at problems, how they choose to solve them and how they interpret the results. In fact, Kuhn even argues that researchers from different paradigms cannot communicate with each other since the way of thinking in one paradigm is not at all congruent with the ways of others. (Patel & Tebelius, 1987, pp. 26-28; Arbnor & Bjerke, 1994, pp. 28-35)

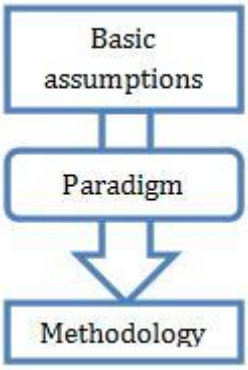


Figure 2.1: The bridge between basic assumptions and methodology. Adopted from Arbnor & Bjerke (1994, p. 29).

Paradigms can be, and have been, categorized to better understand their inherent features. Furthermore, they can be compared to better understand the differences in probable thinking and acting within them, and how these differences can potentially and actually affect for example research results. For example, if the researcher's paradigm is *positivistic*, he or she believes that there is one *true reality* that you can learn about through observations. A statement needs to tell something about that true reality in order to be scientifically valid. To be able to determine if it is true or false, the statement also has to be about observable sensory impressions. Knowledge is accumulated by verifying or falsifying statements and the results lead to the one true reality. Another important aspect of positivism is that research should be organized, meaning that general principles and rules must be

possible to show. (Patel & Tebelius, 1987, pp. 26-32; Björklund & Paulsson, 2003, p. 65)

Another paradigm is the *hermeneutic.* Here, the language and basic values of people particularly emphasized. Since these form a frame in which we interpret, understand and communicate the world, e.g. research results are always seen through the lenses of language and basic assumptions. People with the same frame tend to understand each other because they define the surrounding world in a similar way. In this paradigm, the importance of differentiating the wholeness from the sum of each component is also underlined. By studying elements in a system, nothing general can be said about the wholeness. (Patel & Tebelius, 1987, pp. 32-35)

The authors believe that the paradigm in this thesis will be a combination of the positivistic and the hermeneutic. It is a fact that there are cultural differences in a big and global organisation like the company's. It is the authors' opinion that these differences will affect the overall performance of the organization in a way that is not necessarily measurable or follows general rules. An example of this is that information may be lost when employees with different language and basic values are communicating. Another example could be that employees with different backgrounds interpret instructions differently resulting in confusion about what is to be done. On the other hand the authors cannot disregard from the fact that they believe in learning through observations. The result of a combination may, according to Kuhn, lead to the thesis not being comparable with other research of a different paradigm. However, Gammelgaard (2004) claims that logistics research is strongly connected to the positivistic paradigm and could benefit by influences from other paradigms.

2.2 Scientific approaches

There are different scientific *approaches* that can be used in a study. Three approaches are usually mentioned and these three are discussed in this chapter. (Arbnor & Bjerke, 1994)

The *analytical approach* is the oldest one and is closely related to the positivistic paradigm. It has a summative character, i.e. the wholeness is equal to the sum of the elements. Using this assumption we can also state that summing up facts about elements in a system will provide a picture of the characteristics of the system as a whole. This is why the best individual elements together form the best wholeness. The requirements for using this approach are existing theory and techniques which make hypothesis testing possible. (Arbnor & Bjerke, 1994, pp. 65-94)

The main difference between the analytical approach and the *systems approach* is that the latter assumes that the wholeness differs from the sum of the elements. The systems approach is based on systems theory and states that elements can be explained from the properties of the system. This means that the relations between elements are of importance as well as each part's individual properties. In other words, this approach is interesting when investigating something where you expect to have synergies between elements in a system. (Arbnor & Bjerke, 1994, pp. 65-94)

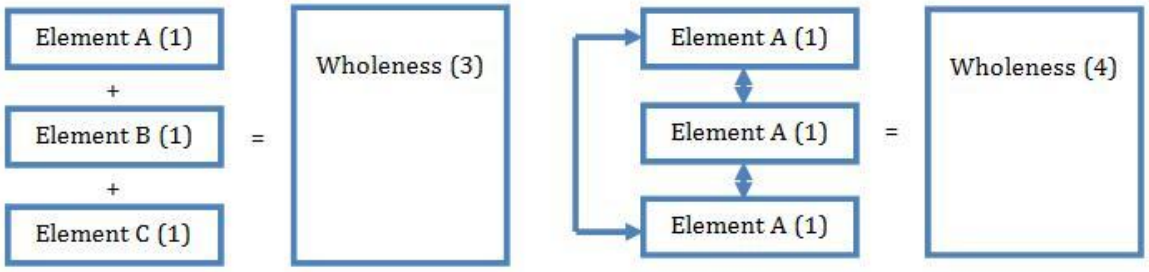


Figure 2.2: The analytical (left) versus the systems approach (right). Adopted from Arbnor & Bjerke (1994, pp. 66-67).

The *actors approach* also takes the relationships and synergies between the elements into consideration but rather means that the wholeness of a system can be understood from the containing elements' properties. It also points out that people have different perceptions of reality depending on their social background. In this way the actors approach significantly differs from the two others which speaks of a more objective reality. (Arbnor & Bjerke, 1994, pp. 65-94; Olsson & Sörensen, 2008, p. 59)

	Analytical approach	Systems approach	Actors approach
Theory type	Determining cause-effect relations. Explanations, predictions. Universal, time and value free laws.	Models. Recommendations, normative aspects. Knowledge about concrete systems	Interpretations, understanding. Contextual knowledge
Preferred method	Quantitative (qualitative research only for validation)	Case studies (qualitative and quantitative)	Qualitative
Unit of analysis	Concepts and their relations	Systems: links, feedback mechanisms and boundaries	People - and their interaction
Data analysis	Description, hypothesis testing	Mapping, modelling	Interpretations, understanding. Contextual knowledge
Position of the researcher	Outside	Preferably outside	Inside - as part of the process

Table 2.1: The Arbnor and Bjerke framework. Adopted from Gammelgaard (2004).

As mentioned in 2.1, logistics research has traditionally been strongly connected to the positivistic paradigm, and thus the analytical approach. The concept of supply chain visibility allows for the actors involved getting a holistic view of and adds to the knowledge about the supply chain. This by itself, however, is not sufficient for better supply chain performance. It will also require the right implementation and usage. This is why the authors believe that much of the aspects in this thesis will concern the relations between the different actors involved. The effects of increased visibility might

also be hard to measure with quantitative data which is the preferred method for the analytical approach. Because of the above mentioned the analytical approach will not be used in this thesis.

Looking at the actors approach, Gammelgaard (2004) states the following:

> *"But humans govern the logistics systems, and unless they are managed extremely well or for some reason are willing to subordinate themselves to the needs of holistic logistics or supply chain management systems, they will exert an influence on the practice of the systems. Applying the actors approach may highlight this aspect of the logistics system, which is usually invisible in logistics research. The approach will enable researchers to gain insight into the actual logistics management processes, providing a more accurate image of the nature of logistics and supply chain management" (Gammelgaard, 2004, p. 489)*

Using this approach the recommended solutions can be compared to the expectations of the actors involved. The approach uses people as the unit of analysis which can help showing effects that with other approaches would be hard to measure.

For the main objective, to develop recommended solutions, the systems approach is selected. As previously mentioned the authors suspect that synergies will appear when the visibility is increased and that there lies a potential in extended co-operation between departments. This approach takes such relations and synergies into consideration. Since the aim is to develop recommendations, the data analysis by mapping and modelling seems particularly suitable for getting a good overview to base decisions on.

2.3 Research methods

To facilitate the understanding of a study's research methods, different categories have been established. A few methods relevant to this thesis will be discussed in this section.

2.3.1 Research types

Depending on the amount and understanding of existing research on a subject, a study can be of different *types*. It is common to use classifications to make it easier to separate studies without having to make detailed explanation about the type.

An *exploratory,* or investigating, study is often conducted when the existing research is insufficient. The aim of these studies is to create new hypotheses and get basic understanding. You often want to gather as much data as possible within the problem area. Exploratory studies are often used in preliminary investigations. Another type of study is the *descriptive* one. Here the aim is to describe and measure rather than to explain. This type of study requires a larger amount and broader understanding of the subject than the exploratory study. There are also other common types like for example the *normative* study, which seeks to give guidance in a subject, and the *explanatory* study, which seeks to explain and get deeper understanding. The goal of an explanatory study can also be to provide evidence to support or disprove a prediction. (Björklund & Paulsson, 2003, p. 58; Arbnor & Bjerke, 1994, p. 99; Patel & Tebelius, 1987, pp. 52-57)

The first phase of this thesis will require an exploratory study in order to really understand the problem and where it mainly appears. The authors also need to understand what processes and activities are relevant for the study. When the problem is clear and the study will be of a normative art. The

concept of supply chain visibility and closely related concepts will be used to seek explanations and possible solutions to the problem investigated.

2.3.2 Qualitative and quantitative research

When determining if a study is qualitative or quantitative it is important to look at the purpose of the study. The determining factor is really what data is gathered. If the data is suitable for measuring or can be analysed numerically, a *quantitative* study is conducted. Such data is often gathered by mathematical methods or surveys. On the other hand, if the data is collected from for example interviews or observations then it is a *qualitative* study. A big difference between the two is also that the qualitative study focuses on creating understanding about a subject while the quantitative study seeks to create general models that explain phenomena in our surrounding world. It is possible though to use a combination of the two; a qualitative study does not exclude the possibility to use quantitative methods as well. (Björklund & Paulsson, 2003, p. 63; Patel & Tebelius, 1987, pp. 43-44)

This study will be written with a qualitative approach. The authors will continuously analyse the data gathered from interviews and databases. Looking at Table 2.1 we can also see that the systems and actors approach are both connected to qualitative data. We can also see connections to our selected data collection methods, e.g. interviews, and to inductive analysis. Quantitative data may also have to be collected and analysed when looking at supply chain performance. The goals with qualitative research are also in conformance with the purpose of this thesis, i.e. understanding the current situation and develop recommendations.

	Qualitative research	Quantitative research
Focus	Quality	Quantity (how many, how much)
Keywords	Fieldwork, subjective, naturalistic	Positivism, logical empiricism
Goals	Understanding, description, discovery, hypotheses generating	Prediction, control, argumentation, hypotheses testing
Methodological properties	Flexible, development, unstructured	Predetermined, structured
Situation	Natural, known	Unknown, artificial
Selection	Small, non-random, theoretical	Large, random, representative
Data collection	Interviews, observations	Tests, surveys, computer processing
Analysis	Inductive (by the researcher)	Deductive (by statistical methods)
Results	Holistic, developable	Precise, detailed

Table 2.2: Characteristics of qualitative and quantitative research. Adopted from Merriam (1994, p. 32).

2.3.3 Inductive, deductive and abductive methods

Within analytical research there is said to be two realities: the empirical, which is filled with facts and the theoretical, which is quantifiable. Research is cyclic and starts with facts which are formed into theories; the theories are improved and then verified into facts (See Figure 2.3). (Arbnor & Bjerke, 1994, pp. 107-108) The following section describes the studies throughout the cycle.

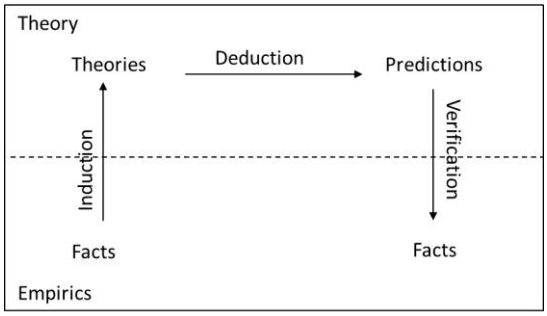


Figure 2.3: The research cycle. Adopted from Arbnor & Bjerke (1994, p. 107).

Inductive studies are based on observations of reality. The researcher tries to find patterns on which theories can be based. The criticism of these studies has been massive even if they are commonly used. One of the major areas of criticism has been the fact that, according to the critics, the selection of observation group or object is based on theoretical knowledge. This means that no studies are based purely on empirics but are always more or less influenced by theory. Critics have also claimed that theories cannot be based solely on observations. There is always a limitation of how many observations can be performed and therefore always uncertainty in the results. (Wallén, 1996, pp. 89-90)

Sometimes inductive methods are required; for example when researching a new field where no earlier theories are to be found. Some inductive methods have also been improved recently to have a wider use. The need of the researchers to be unprejudiced has been used as one argument to why inductive methods should be used to a wider extent. (Wallén, 1996, pp. 89-90)

Deductive studies do, unlike inductive studies, approach research based on already existing theory. Deduction is useful if the researcher wants to test how well theory supports different cases. Hypotheses are set up, based on what is to be tested, and are either accepted or discarded through studies of empirical

data. To be able to set up relevant hypotheses the researcher is required to have good knowledge about the theory on the subject. Through *verification*, facts can be based on the findings in the deductive study. (Wallén, 1996, pp. 47-48)

Abductive studies do, unlike both inductive and deductive studies, not approach research from just one perspective. The abductive methods approach research both from an empirical and a theoretical point of view. The methods seek to find the theoretical cause to a certain empirical observation. There might be several possible causes to an observation and many conclusions are tested and excluded during a study. Wallén (1996) compares the abductive studies with the procedure of a medical diagnosis. Unlike deduction, abduction lacks possible factors to manipulate and through this find a connection to the observation. This is why the methods are thought to be more related to induction than deduction. Abduction requires great experience from the researcher and the studies cannot be carried out according to a predefined template. (Wallén, 1996, pp. 47-48)

In this thesis propositions will be tested against verified against empirical findings. Even if the propositions are partly based on theory the study is still to be considered inductive. This is also the most common approach when conducting an exploratory study as in this case. The use of inductive methods is also supported by Table 2.2 which indicates that analysis in qualitative research is of an inductive art.

2.3.4 Triangulation

Triangulation is described by Bryman (2002):

> *"Triangulation refers to the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings." (Bryman, 2002, internet source)*

According to Olsson & Sörensen (2008) different dimensions of a problem is also visualized which provides a more complete picture of the problem. Though the aim is to enhance credibility, the concept has also been criticized. For example, triangulation assumes that data collected with different research methods can be compared. This does not take into account the different social circumstances associated with the administration of the different research methods. (Bryman, 2002) This is also connected to the problems related to the paradigm concept discussed in 2.1.

Further, Denzin (1970), as cited in Bryman (2002), has distinguished four different forms of triangulation:

1. *Data triangulation*, which entails gathering data through several sampling strategies, so that slices of data at different times and social situations, as well as on a variety of people, are gathered.
2. *Investigator triangulation*, which refers to the use of more than one researcher in the field to gather and interpret data.
3. *Theoretical triangulation*, which refers to the use of more than one theoretical position in interpreting data.
4. *Methodological triangulation*, which refers to the use of more than one method for gathering data.

To enhance credibility in this thesis, the authors will try to use the fourth and most common form, *Methodological triangulation*. This is illustrated in Figure 2.4. Due to limited time and resources this type of triangulation is the only one possible to carry out in this thesis.

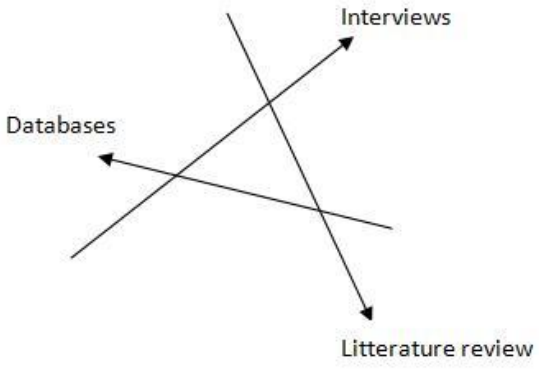


Figure 2.4: Methodological triangulation.

2.4 Research design

According to Merriam (1994), the design of a study depends on the research problem, what questions it raises and what the desired result is. The main thing to consider though, when selecting the research design is to think about the scope of the investigation, i.e. number of units versus number of variables investigated. In this thesis the number of units, or areas of improvements investigated, is small while the number of variables is big. Therefore, experimental design is not an option because here you seek to investigate single variables. Other options available are case studies, which are qualitative by nature, and surveys which are quantitative. (Patel & Tebelius, 1987, pp. 58-62; Merriam, 1994)

To investigate the problem areas in this thesis more deeply and in a qualitative way, case studies might be a suitable method to use. This method is

also preferred in the system approach which further suggests the selection of it.

2.4.1 Case studies

The term case study is often confused with *case method* which is a teaching approach for illustrating how to solve different problems. Different data collection methods can be used depending on the research problem and the preparations required are often major. Case studies have its advantages but it also have some restrictions. The most apparent restriction is its disability to generalize from a smaller investigated selection to a larger. On the other hand, the ability to generalize from one context to another is seen as a great advantage. Since the analysing part of this thesis will focus on a supply chain limited to one business area and key customers, this latter ability will be useful when trying to generalize to and benchmark with other business areas. Another advantage is that case studies takes three "dimensions" of time into consideration, the past, the present and the future, i.e. the researcher has to participate in a sequence of events. This could help explain conditions that were previously unknown or had been perceived differently. (Patel & Tebelius, 1987, pp. 58-62; Merriam, 1994; Olsson & Sörensen, 2008, p. 82)

Yin (2006) describes four different types of case study design as shown in Figure 2.5. The matrix represents two dimensions; single or multiple-case design and single or multiple units of analysis.

	Single-case design	**Multiple-case design**
Single unit of analysis (holistic design)	Type 1	Type 3
Multiple units of analysis (embedded design)	Type 2	Type 4

Figure 2.5: Four different types of case study design. Adopted from Yin (2006).

Single-case design means that one case object is studied in order to answer the research questions while multiple-case design investigates two or more case objects. Which one to choose depends on the research questions. For example, if the purpose with the research questions is to verify existing theory, single-case design is more suitable to either verify or reject hypotheses. Also this design is preferred when looking at unique or extreme cases. The multiple-case design is used when the researcher wants to analyse case objects which are replications of each other. This is often more complicated, and requires some knowledge about the outcome, than single-case design but provides a more reliable result. (Yin, 2006, pp. 60-77)

When studying a case, for example a big organisation, the researcher can choose to analyse the outcome of that organisation as a whole but also to look at different departments' outcomes. This is called holistic (single unit of analysis) and embedded design (multiple units of analysis) respectively. (Yin, 2006, pp. 60-77)

The aim of this thesis is to analyse the impact on the company organisation as a whole which calls for a holistic design. Since the major problem investigated, warehousing appears in the entire organisation but in different contexts depending on the BA, cases from different BAs have to be chosen. However, the operational work is done on a product segment level which is why the cases need to be chosen from this, lower level. The cases selected are newsprint, fine paper and carton board. The reason for only choosing three segments was due to time restrictions. Cross-case replication logic (Yin, 2006) was used which means that certain factors are kept constant while others deviate. In each case investigated in this study the sales process and the ERP-

system are the same while factors such as product, market, geographical location and working procedures vary between the cases.

The authors believe that these cases will cover the significant differences and similarities between the company's different segments. The results from the study can then be compared and possible connections and generalizations can be found. In others words, a case study of Type 3 in Figure 2.5 will be conducted.

2.5 Validity, transferability and reliability

The term *validity* differs a lot between the different approaches and often a distinction is made between external and internal validity. Within the analytical approach, internal validity is primarily seen as the extent to which a measurement's indicator corresponds to the definitions. The system approach, which does not have as strong connections between theory, definitions and reality as the analytical approach, has a different view on internal validity. It is here seen as the possibilities to decide whether the measures were done correctly and whether the results are reasonable. Within the actors approach, validity can have different meanings. The reason for this lack of general definition has to do with the opinion that every person has different perceptions of reality. This also makes validation seldom used when talking about the actors approach. (Arbnor & Bjerke, 1994)

In this thesis, which mainly has a system approach, good internal validity will be ensured through interviews with several persons where the same questions are asked. To avoid the risk of unprepared answers, which can contain errors and misunderstandings, the interviewees will be given the possibility to read the questions well in advance to ensure valid answers. All information given in the interviews will to the extent possible be validated

through secondary sources. This is especially important in the cases where only one interviewee has given information.

External validity reflects how well the results from a study can be generalized into other contexts. Within a qualitative approach external validity is sometimes referred to as *transferability*. The transferability is judged by external researchers based on the context of the study and its methods. (Trochim, 2006) In this thesis the authors will try to describe the context of the study and the process in detail in order to simplify other researcher's determination of whether the study is transferable or not.

Reliability is within the analytical approach said to be the probability that a measurement gives the same result if repeated. This is mainly interesting when the results are quantitative since it is difficult to compare qualitative data. Reliability is for the same reason seldom interesting within the system and actor approach which focus on qualitative data. (Arbnor & Bjerke, 1994) The data handled in this thesis will, as discussed in 2.3.2 mainly be qualitative and the authors will therefore not try to determine whether the gathering methods are reliable or not.

2.6 Data collection and analysis

Different factors have impact when deciding what type of data collection will be used. It has already been concluded that this thesis will mainly consist of qualitative data, have an inductive approach and will be both exploratory and explanatory by nature. For example, the inductive approach suggests that interviews and databases will be of great importance to make up for the lack of theory. These factors along with the chosen research design, case studies, have led to the working procedure illustrated in Figure 2.6. The procedure, which is divided into four phases, will be described briefly below. After that,

each of the data collection and analysis methods will be described more in detail.

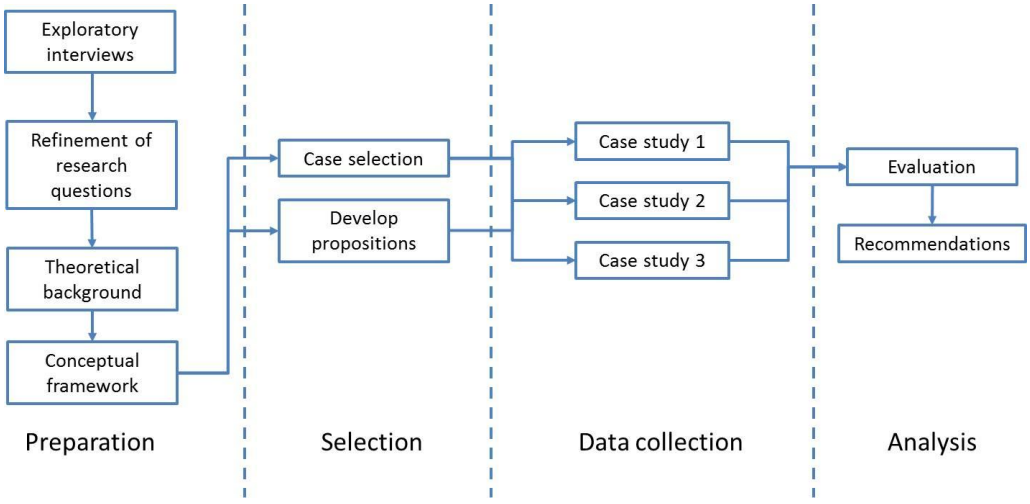


Figure 2.6: Case study procedure. Inspired by: Yin (2006, p. 72)

The preparation phase included an extensive literature study to be able to get a grip of the theoretical background and existing research. The authors also conducted exploratory interviews with a numerous people at the company to prepare for the case selection. When the cases had been selected, the authors also developed propositions regarding what information is favourable to share etc. Depth interviews along with data extraction from the ERP-system were then conducted. Finally, evaluations of each case were done and the propositions were tested against our empirical findings. This lead to the last step, which was providing the company with recommended solutions.

Primary and secondary data

Primary data means data collected by any well-recognized method while *secondary data* has already been collected by another researcher. Published scientific articles and other printed material are therefore seen as secondary data. Such materials always have to be reviewed critically in order to

determine the originators purpose and credibility. (Olsson & Sörensen, 2008) This subject is discussed more in detail under the data collection methods concerned.

Literature study

First a literature study was carried out to ensure a good approach to the research and to get an overview of the existing theory. Most of the information was collected from scientific journals and articles. These were found in well recognized databases to ensure high reliability. Key words that were used when searching the databases were: "information sharing", "supply chain visibility" and "supply chain management". The field of supply chain visibility is relatively new and in rapid development which is why books on the subject were hard to find. As discussed earlier it is always important to critically review secondary sources. The theories and statements in an article were therefore always verified with other sources.

When the data collection had been made and before the analysis was written, a second literature study was conducted to further extend the knowledge on the relevant subjects and to help interpreting the results. The procedure was similar to the one in the previous literature study.

Interviews

Interviews are a commonly used data collection method within all the research approaches. The method gives the researcher possibilities to collect both quantitative and qualitative data depending on the approach of the research and the purpose of the interview. (Arbnor & Bjerke, 1994) The different interview types that can be used are presented in Table 2.3.

In the early, more exploratory, phase of this study interviews were used to map the current situation at the company and to prepare for the selection of

case studies. According to Patel & Tebelius (1987) interviews is the preferable method in such study. The data wanted was qualitative and the interviews were therefore not very structured. To avoid the personal opinions to affect the final analysis several persons was interviewed through a more standardized questionnaire with open questions. This ensured validity which is discussed more in detail in section 2.4.1. A total of three persons at the company were interviewed, each having a managerial position in one of the three business areas. This provided a good overview of the current problems and gave the authors an idea of where there might be information gaps. The major common problem that was found was too high inventory levels. The interviewees provided different explanations to this but all agreed that increased visibility could be a possible solution.

In the later phase, where the study required a deeper analysis, more personal interviews were conducted with key persons. This allowed personal reflections and can according to Olsson & Sörensen (2008) sometimes give unexpected information from the interviewee. When conducting this type of interviews it is important to keep in mind that with lower level of standardization and structure the uncertainty rises. Possible confounding might be the assumptions by the interviewer regarding the respondent's knowledge, opinion and behaviour. Also the place of the interview might affect the answers, for example the risk of others overhearing the answers. It is also important to be aware that the answers can be ambiguous. (Olsson & Sörensen, 2008) Interviews were carried out with three persons in each case object. To be able to generalize and find distinctions between the cases, persons with the same role and responsibilities were chosen from each case object. All the interviews were semi-structured and based on the interview guide in the Appendix. The reason to why semi-structured interviews were used instead of more structured interviews was to allow the interviewees to

give personal reflections and to be able to follow up interesting findings along the interview.

	High level of structuring	Low level of structuring
High level of standardization	Survey or interview with fixed answering alternatives, quantitative analysis of survey/interview answers	Survey or interview with open questions, projective methods
Low level of standardization	Focused interview	Qualitative analysis of interview answers, journalistic interviews

Table 2.3: Different types of interviews and surveys. Adopted from Olsson & Sörensen (2008, p. 81).

Observations

Except from interviews observations is also considered as a good data collection method when doing qualitative research. The benefits with observations are that the researcher can see for itself and do not have to rely on somewhat secondary information that is collected through interviews. Merriam (1994) describes four types of observations:

1. *Completely participating.* The researcher is a member of the group that is observed. The situation might be difficult for the researcher since the role as observer might conflict with the one as a member of the group.
2. *Participator-observer.* The researcher's role as an observer is known to the group but the role as an observer is inferior to the role as participant. This might affect the quality of the collected data.
3. *Observer-participator.* Also here is the role as observer known to the group and the observer role is superior the one as participant. Much information might be gathered but the quality of the information is dependent of the group's willingness to cooperate.

4. *Completely observing.* The observer is invisible to the group observed. (Merriam, 1994)

In this study the authors have done some of the work at Hylte mill and have through this had the possibility to observe the sales administration's work at the mill. The observations have only been a complement to the interviews and more been used as confirmation of what has been found during the interviews. Also the authors have used the software investigated in order to get a good view of its usability

Databases

The quantitative data concerning the company was collected from the ERP-system. When collecting data from databases it is important to validate the quality of the information gathered. The researcher must reflect on the reason to why the information has been put in the database, in what context the information was generated, if and why the data have been processed and what the purpose with the data is. (Wallén, 1996) In this case the information was unaffected raw data generated through actual business transactions. The data can therefore be considered as reliable.

Analysis

The process of analysing information is meant to give it a meaning. However, to separate empirical findings from analysis of collected data could be misleading. This is due to that data collection and analysis is done simultaneously within qualitative research. Ideas and intelligent guesses direct the focus of the researcher to certain areas of the information which means that the data collection and analysis is a recursive and dynamic process. This does not mean, however, that the analysis is complete when all data is collected; it is just entering a more intensive stage. (Merriam, 1994, p. 136)

When the data collection is complete, the data has to be organized in order to make the more intensive analysis efficient. All information needs to be compiled, for example interviews need to be transcribed. Yin (1984) as cited in Merriam (1994, p. 139), referes to this compiled data as the case study database. In this study all interviews have been transcribed and the interview guide can be found in the Appendix. When conducting case studies, the level of analysis can vary. The data collected can be organized and presented together, or divided into categories which are represented by the different cases. (Merriam, 1994, p. 140)

To analyse the empirical findings, an analysis model was created based on the conceptualization in the frame of reference. This model is described more in detail in section 4.3.4. The model was then used to analyse the three cases separately, but also a cross-case analysis was conducted in order to find generalizations. Propositions were also developed in order to use the pattern matching method later on (Yin, 2006).

The analysis process was continuous throughout the whole study and after every interview the authors reflected on the results and compared them with the analysis model according to the qualitative analysis approach. After the data collection, the data was organized to one of the three cases and information not relevant for the study was sorted out. This allowed for a description of each case to be made. To facilitate the cross-case analysis a table summarizing the most important factors according to the analysis model was created. This was done by each author by himself and then the tables were merged into one, to make sure nothing was missed. The table along with the case descriptions were then used in order to match for patterns.

3 Company description

In this chapter some background facts about the company will be presented as well as a description of the organisational structure and the supply chain. The purpose is to give an idea of what business the company is operating in and the context of their problem.

This chapter about the company will provide the reader with information that will be useful when continuing to the empirical and analytical chapters.

3.1 Company background

The company group employs about 30 000 people and have production facilities spread in several countries. The customers are also found all over the world and include publishers, printing houses and paper merchants but also packaging, joinery and construction industries.

They believe the company will have a big role in reducing the carbon footprint and decrease the emissions of greenhouse gases with its products made of renewable materials. The company is convinced that fibre based packaging will compete against packaging made out of fossil materials and thereby be a growing area in the future.

3.2 Organisation and supply chain

The company is organised into four *business areas* (BAs); which is called business area 1-4. Some BAs are further divided into *business units* (BUs). Within each BU there might also be different product segments. Often the operative work is performed segment wise since there might be differences between them.

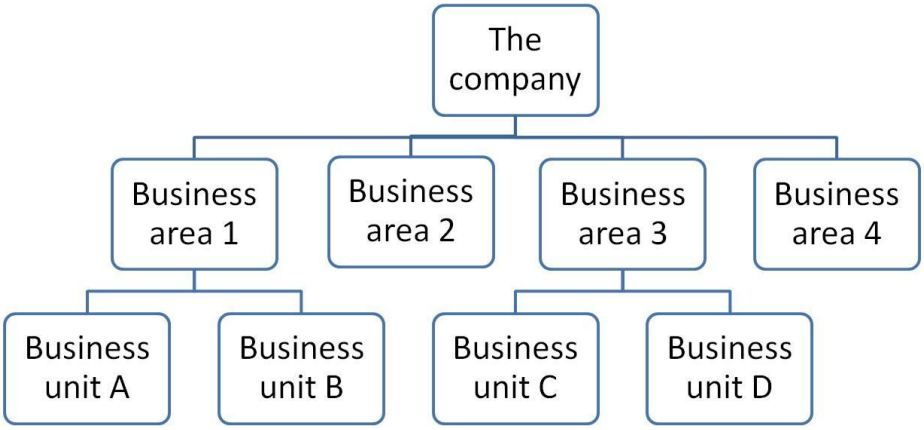


Figure 3.1: The company's organisation.

The company's sales organisation has recently been re-organized. The new organisation has yet only been implemented in Europe. The different actors are shown in Figure 3.2 and described more in detail below.

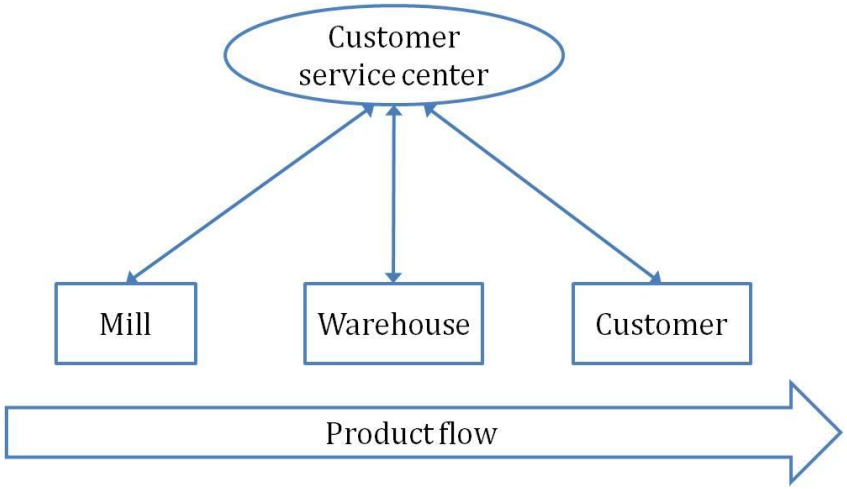


Figure 3.2: The new sales organisation.

After the re-organisation each BA has its own sales organisation instead of one common. The new organisation is built up with *customer service centres* (CSCs) instead of country specific sales offices. The CSCs have taken over some of the

administrative work that was previously done by each mill and are doing the work done by the sales offices before. The CSCs work as the link between existing customers and the company. Each BA decides how many CSCs are needed to serve the customers. Currently the group have 13 CSCs which have replaced 30 sales offices. The more centralized organisation is thought to give economies of scale but also offer better service to customer's specific needs. The CSCs handle the orders from the customers and are then responsible for ordering from the production units. Their tasks include both customer specific service and general sales administrative work.

As a part of the CSC there are country specific *field sales.* It is those who contract the customers. Another part of their work is to develop a sales plan. A sales plan is an indication of how much field sales believe they will sell to each market each month. The sales plan is continuously updated and spreads over 12 months ahead. Depending on which BA, the sales plan is locked for editing different dates but between the 15th-25th each month the sales plan for the coming moth must be final. The sales plan should give an idea to the mills of what to produce and the mills looks at the sales plan when deciding how much quota to put for each market.

The *mills* plan the production and arrange the transports of the orders produced. They plan their production roughly by deciding what quota each market should get. When the orders are placed by the CSCs the production planners at the mill decide exactly how the orders should be produced on the machines.

The mills are separated in four major categorizes; paper, pulp, packaging board and wood products mills. Depending on the product produced their work differs a lot. Some products are more standardized while some are very

customer specific and requires a high level of flexibility. The company has, as many other companies, been affected by the financial crisis in recent years and some of the less competitive units have been closed.

3.2.1 The logistics organisation

Some supportive activities that are needed by the whole group are separated into their own organisations. One of these organisations is the logistics organisation. They work as an independent organisation and support the group within their work with logistics.

They create value through the daily work with procurement and management of transport, warehousing and distribution of the group's products. However, the actual storage, transportation and other logistics services are carried out by contracted suppliers. The renewal of logistics is done continuously and often in collaboration with other parts of the group. The organisation strives to improve the performance of the supply chain and is looking at both technical and organisational changes that could achieve this.

3.3 The sales process

Figure 3.3 below illustrates the sales process at the company. The sales process is divided into four activities which all contribute to the final delivery at the customer. All of these activities affect the inventory levels and are therefore interesting for this thesis. Note that these processes have not been defined by the company but by the authors as a result of the interviews. Below, each activity is briefly described.

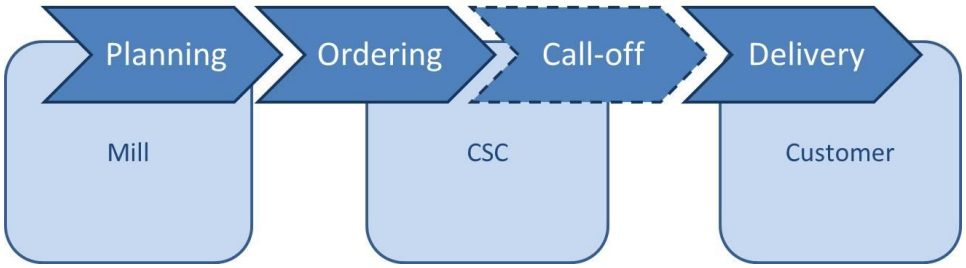


Figure 3.3: The sales process at The company.

3.3.1 Planning

The first activity in the sales process is planning. The idea of this is to determine what will be produced in the future and how large quantities. It also includes deciding how the distribution between the mills should look like, i.e. what mill will produce what product to what customer. This, along with production costs, prices and locations are aspects to consider when investigating whether a customer is profitable or not. In the newsprint segment, all these responsibilities belong to the Master Planners. The people responsible however, can be different in other business areas. (Carlsson, 2010)

The planning starts with field sales making a sales plan for the future. In this sales plan, focus is on predicting the sales for the coming month even though it stretches 15 months ahead. To make sales plans as accurate as possible, forecasts are often collected from customers. The accuracy of the forecast can vary a lot depending on the product. For example in the newsprint segment the customers can have a very hard time predicting the customer demand and that makes it hard to provide good sales plans. Also customers are sometimes not even willing to share any information due to fear of the company spreading the information to competitors. Each month, generally on the 25th, the sales plan is locked for editing the coming month. However, different rules apply for different business areas, for example fine paper demands an updated plan for two months ahead that is locked in the middle of each month. Except from sales plans historical data is sometimes analysed. Especially in fine paper this has been very successful and the company can even make better predications than the customers themselves. The Master Planners (or corresponding people) then use these sales plans or forecasts in the next step which is called quota management. (Bremberg, 2010; Sandberg, 2010; Deppe, 2010; Erbach & Preis, 2010)

Quota management is about assignment of capacity. A certain quantity, or quota, is assigned to a market for a given period of time, usually one month. A market can refer to either a geographical or a segment wise market. The idea of a quota system is to ensure a fair distribution of capacity so that one market does not receive all the requested orders in time while another market gets to wait. The quota is primarily based on the sales plans and rough production planning. These quotas are not unchangeable and discussions are held with customers service centres if changes are needed. (Carlsson, 2010; Popowski, 2010)

3.3.2 Ordering

The orders and almost all communication with customers are received by the sales coordinators at the CSCs. This is almost always done by telephone. Before the order can be approved and sent to the mill for production there are a number of factors to consider. First the sales coordinator needs to check the quota so that there is still production left for the current market. The next thing to consider is how well the customer has specified the order. A customer may order up to a 1000 tonnes of paper not specifying exactly when it is needed. To cope with these problems sales coordinators need to look at historical sales data as well as having a dialogue the customer every time an order like that comes in. (Erbach & Preis, 2010; Järbur, 2010)

Due to quota management and production cycles, sometimes some puzzling needs to be done to split up orders into smaller ones. Here it is the sales coordinator responsibility to have a dialogue with both the customer and the producing mill. Other times orders can be split up to try to fit in as many specifications as possible in a week. For example, if an order comes in for 100 tonnes and the sales coordinator knows from experience that the customer only will need 50 tonnes that week and 50 the next, the order can be split up to make room for other orders. Optimizations like this are important since it is high pressure on the production and switching machine set ups are expensive. For such optimizations however, there are no formal routines but they rather depend on personal initiatives. Figure 3.4 illustrates an example of how a production planning system might look with different cycles of each paper quality. (Bremberg, 2010)

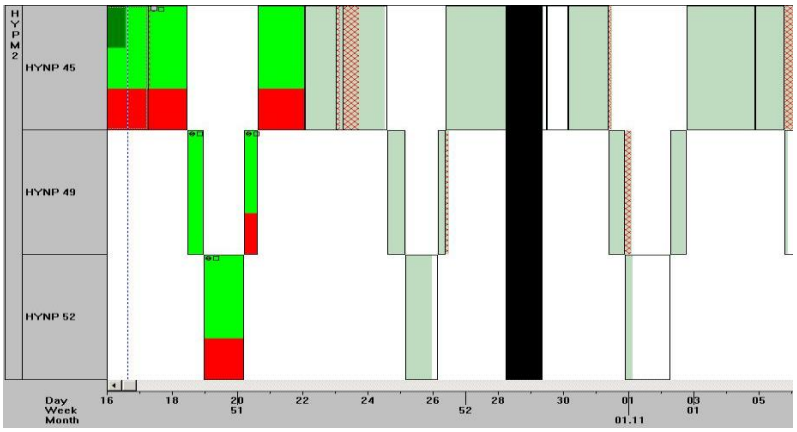


Figure 3.4: Example of production planning with different qualities.

Most sales coordinators are aware of what an optimal truck load is. The directives from management however vary a bit. Some customers service centres have stated directives to take this into consideration when receiving orders and making call-offs while others use it more informally. (Bremberg, 2010; Popowski, 2010)

Many of the orders are recurrent. In newsprint for example they talk about approximately 80% of all orders being the same every week. However no systems for automatic ordering are implemented and customer always need to call in to place new orders. (Carlsson, 2010)

the company generally has two different kinds of orders. Either an order is produced and delivered directly to the customer, generally without any warehousing in between. These are called *direct deliveries*. However, in some cases, to avoid switching machine set ups, direct deliveries can be produced based on forecasts and warehoused for a while. The other kind is produced based on order but are being warehoused before delivered. This kind is hereafter referred to as *call-off orders* and will be described more in detail in

the next section. What kind of order is used mostly depends on the mills location, the customers' demands and the type of product. (Carlsson, 2010)

3.3.3 Call-off

When the order is produced and put in warehouse it need to be called-off by the customer if it is a call-off order. How common these kinds of orders are depends very much on what business area it is. Major differences have been noted between the three cases investigated in this study. Within fine paper, call-off orders are very rare. Within both carton board and newsprint it is on the other hand quite common. Carton board also have noted an increasing interest among customers for these kinds of orders. Within newsprint it is the most common type of order and has very much to do with the business context and traditions. (Sandberg, 2010; Andersson, 2010; Popowski, 2010)

The call-off procedure is pretty much the same as the ordering with the difference that the paper is already in stock and can often be delivered to the customer within one day. The customer contacts the CSC and specifies what is needed. A call-off does not have to concern just one order but might be a mix of several orders with different specifications. The call-off from the customer however, does not specify which order to deliver from but just specifications or in the cases when used, what articles they need. In most cases the customer are aware of how to optimize the truck loads and takes this into consideration when calling-off. If this should not be the case the customer service coordinator need to optimize the call-off and discuss this with the customer. When it is decided what the customer need the customer service coordinator registers the call-off in the ERP-system based on what is available in stock. (Bremberg, 2010)

All paper that is warehoused is owned by the company which also pays the warehousing cost. Even if the company owns the inventory it is not always

they who are responsible for the stock levels. In some cases the customers are responsible for replenishing the stock and they often do this monthly. When placing these replenishment orders, which are to be called off ahead, the information regarding the delivery plan might be very different depending on the customer. Some customers specify very well what they will need each week while other do only specify what total amount they will need. The customer service coordinator often has to divide such orders based on experience. The reason to why the customers give such bad predictions is said to be that it is hard for them to predict their demand. Especially within newsprint this is a problem since the customer's demand is dependent on how many newspapers are to be printed a certain day. As mentioned earlier, in some cases when the customer service coordinator can see that the order is too big he or she asks the customer to divide it in order to get less variation in stock levels. As indicated previously it is not always the customers that are responsible to keep sufficient stock levels. Sometimes it is the customer service coordinator that needs to monitor the stock levels and place new orders when needed. In these cases the customers have contract to get a certain amount of paper during a certain time period and the deliveries keep up until the contract is finally delivered. In some very special cases the company is responsible for the stock levels but still there is a minimum stock level agreed to keep. However, these are very special cases. (Bremberg, 2010; Deppe, 2010)

3.3.4 Delivery

By delivery the authors mean the final delivery to the customer but this activity also includes warehousing. It could be either a direct delivery from a mill or when an order is being called off from a warehouse. The company only uses external transporters who are being contracted by the logistics organisation. When a delivery has been decided a transport can be booked according to these contracts. If it is a direct delivery it is the mills'

responsibility to make the booking with a transporter and if it is a call-off order the CSC takes care of the booking. At the fine paper mill a system called TOPSY has recently been implemented where the transporter has access to the production system and the ERP-system. This way, the transporters can see when the orders are finished and when they are supposed to be delivered to the customer. They can then plan the delivery themselves. (Bremberg, 2010; Järbur, 2010)

Since much paper is being warehoused before delivery it is important to monitor the stock situation. This task belongs mainly to the sales coordinators at the CSCs but to some extent also to master planners, mill order planners, production planners and delivery planners. (Bremberg, 2010; Erbach & Preis, 2010; Popowski, 2010; Carlsson, 2010)

The logistics organisations are the ones initiating a new warehouse. Either they have found benefits in terms of transport costs or they have a customer that demands a certain lead time which cannot be fulfilled from existing warehouses. All warehouses are contracted annually; however there is no minimum fee but the company pays for the capacity they use. When warehouses are contracted field sales are informed and always aware of which warehouses are available to use. (Sundin, 2010)

3.4 Software tools

As the technology develops the technical tools used in the sales process and within companies become even more important for the companies to be competitive. Also the company is using variety of IT-tools in their sales process. Below, the most important for this study which is the ERP-system and a new program, Microsoft MapPoint, is described.

The ERP-system is the main software used in the sales process. In the system the orders are registered and then all sort of information regarding orders and customers are to be found here. All the stock figures and historical sales are also possible to get from a very extensive report system which exists in the system. As in most systems all people do not access all information but this is filtered depending on what is supposed to be usable in the daily work.

Except from the ERP-system the different mills sometimes have mill specific systems for handling for example production and transportation, among which TOPSY at the fine paper mill have been mentioned. However, most of the information that is of interest for the whole organization is transferred into the ERP-system. Also there are sometimes other software tools that use information from the ERP-system but only present it in a new format. Any detailed mapping of all the different systems is however not believed to be of interest for the outcome of this thesis. However, the company has new software available that can be used of presenting information from the ERP-system in a different way. The software is MapPoint. The program can be used to visualize on a map where for example customers are located or where inventory is located and how big quantities of inventory there are at each site. The program is not in use in the daily work but more as a presentation tool for management to use. It has not been evaluated whether this might be a good and supportive tool for the staff working operational in the sales process. An example of what a map from MapPoint might look like is illustrated in Figure 3.5.

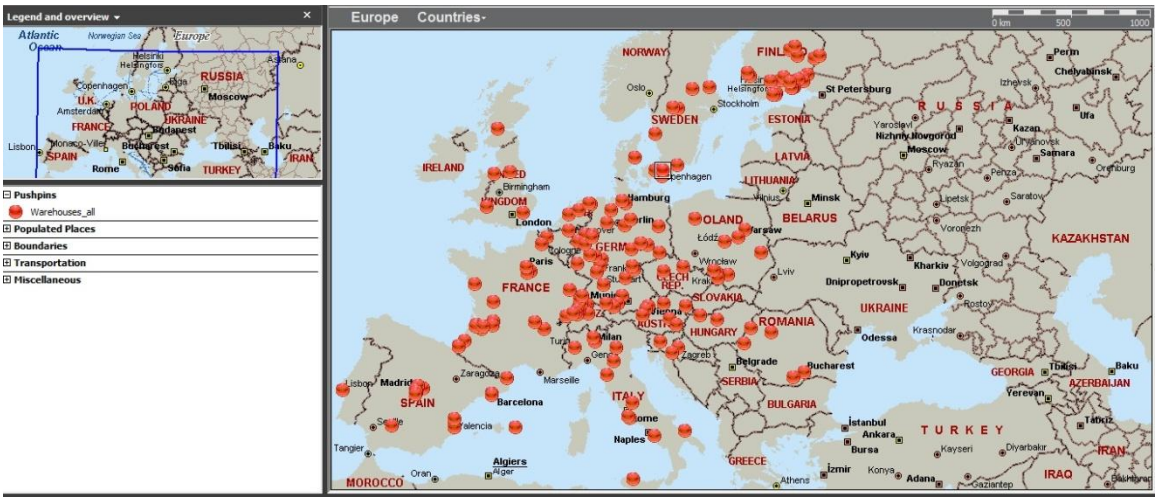


Figure 3.5: A map in MapPoint showing warehouses.

4 Frame of reference

In this chapter the theoretical framework will be presented. A conceptualization will also be presented in order show how the theory is applied in this study. The different parts of the conceptualization will be described in detail and summarized in an analysis model.

Since the purpose includes investigating the concept of supply chain visibility this was the starting point. However, to fully understand its origins and meaning, closely related concepts were also reviewed. The theory behind bullwhip-effects will also be discussed. This theory explains how lack of information can lead to increased inventory levels which could be the case at the company. Also the benefits that can be achieved from supply chain visibility and the related concepts will be reviewed in order to further understand why the concepts are interesting to the company.

4.1 Supply chain visibility and related concepts

The concept of supply chain visibility is fairly new and has so far not been as extensively covered in the scientific literature as other concepts within supply chain management. Besides from covering the available research on supply chain visibility, the authors will hence also touch upon some other close lying concepts in general, to further understand the context of and the importance of different aspects of supply chain visibility in particular. The concepts presented and their relation is illustrated in Figure 4.1.

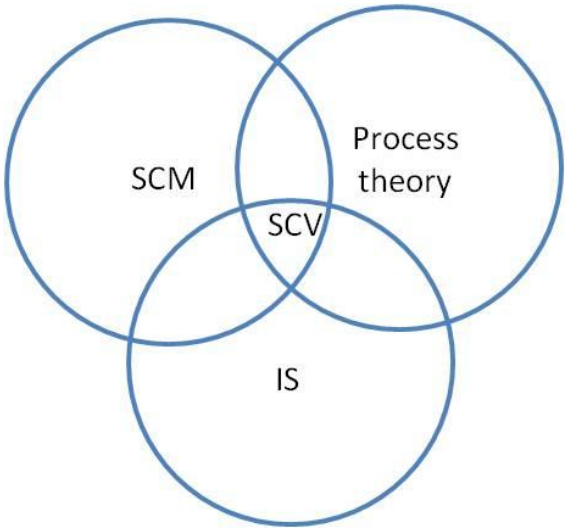


Figure 4.1: The relationship of the concepts

4.1.1 Business processes

As the environments companies are operating in have changed a more process oriented view of producing and distributing companies have become important. Traditionally companies have been organized into functions. The different functional departments have had clearly divided responsibilities and tasks and a functional manager that is responsible for each department. However, in order to deliver value to the company's customers all functions and departments need to contribute to the value in a chain of activities. When too many actors get involved in a chain like this there is a risk of increased lead times and less ability to quickly adopt to market changes. As the market demand shorter lead times and more flexible organizations the drawbacks of the traditional view have become more obvious. This has led to the need of a more flow oriented organizational structure. (Mattsson, 2002)

The new organisation is built up with processes which all represents a flow of material and information. The functional boundaries are wiped out and clearly

defined processes are formed. Central for this new way of organizing companies are or course defining business processes. A business process should have a clear input, a logically built up set of activities and finally an output. The ultimate goal of each process and activity is that it should build up value to the final customer. What is important to keep in mind though is that processes never have a beginning and an end, these have to be defined. This also gives the opportunity to define the final customer which might be either an internal or external customer or another process. It is in other words possible to view processes from an intra-firm perspective or as inter firm perspective. In both cases the processes will be cross functional with the only difference that in one of the cases the process will also be across companies. The challenges are in most cases the same, to manage and coordinate the processes and its' activities to achieve value for the customer of the process. (Mattsson, 2002)

According to McAdam & McCormack (2001), business process management has traditionally been about improving the linkages between internal processes while supply chain management has been about improving the linkages between firms. However, to be successful in a global market they suggest that a holistic approach is needed to view the supply chain as one business. The key enabler that was suggested for improving performance with a more process based organisation was originally information technology. However the last decade communication, or information sharing, has been put forward instead. This allows for information to flow between functions and partners within the supply chain. The communication needs to be equivalent between activities in different organisations and it also needs to be between members of the same business process instead of function or location. (McAdam & McCormack, 2001)

This is an important aspect to investigate further at the company because of the recent restructuring of its organization. Now different business processes involves several organizations at different locations. One key factor in succeeding with this new structure is to utilize world-class electronic communication systems along with common simplified processes. (McAdam & McCormack, 2001) As the company heading in a more process oriented direction the supply chain becomes more complex and communication of a common goal becomes more difficult. McAdam & McCormack (2001) have identified some difficulties that can arise with increased complexity of the supply chain. They claim that small inventory buffers are easily built up between activities but they will over time add up to a significant level for the supply chain as a whole. Another problem that can be derived from increased complexity is the *bullwhip effect* which is discussed more in detail in section 4.2.1. Similarities between the business process concept and supply chain visibility can also be found in literature. McAdam & McCormack (2001) state:

> *"Business information, including order details, inventory levels, directives and product changes, must be communicated to people who need it, when they need it, wherever they are." (McAdam & McCormack, 2001, p. 118)*

4.1.2 Supply chain management

According to Schary & Skjoett-Larsen (2001) the concept of supply chain derives from the Value Chain framework of Michael Porter (1985). Porter's framework describes a series of primary processes that add value to the output of a company. The processes are inbound logistics, operations, outbound logistics, sales and services. Further Schary & Skjoett-Larsen (2001) describes the expansion of this framework by other writers, Mannheim (1994) and Treacy & Wiersma (1993) among others, into three parallel flows: *Product development*, *Customer relations* and the *Supply chain*. The supply

chain is the flow including the organisation and flow of materials and other resources to produce and deliver the product to the end customer. Normally all the flows are separated but sometimes they come together to serve the customer, this is illustrated in Figure 4.2.

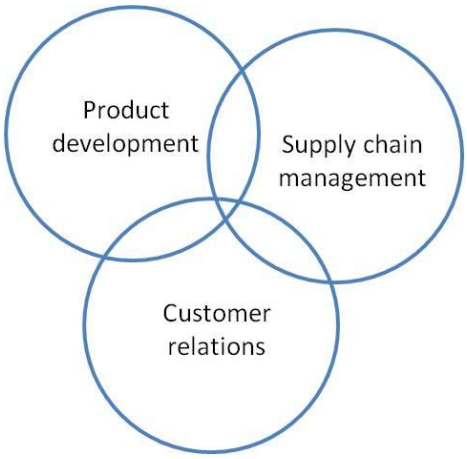


Figure 4.2: The major processes of business. Adopted by: Schary & Skjoett-Larsen (2001, p. 24)

With this in mind it is easy to see why supply chain management is as wide and includes as many activities as it does. It includes not only managing the supply chain flow but also managing the cooperation with the two other flows. One definition to describe the core of the concept is the definition by Cooper & Ellram (1993) as cited in Schary & Skjoett-Larsen (2001):

> *"An integrative approach to manage the total flow of a distribution channel from the supplier to the ultimate customer" (Schary & Skjoett-Larsen, 2001, p. 25)*

This of course has different impact depending on the company. The distribution channel stretches from raw material to the customer. The flow of

the distribution channel includes material, product and information flow. The flows crosses many boundaries, it could be functional boundaries (e.g. product and development, production) and organisational boundaries which could be both inter- and intra-firm. In many cases these boundaries are also geographical. The integrative part of supply chain management should coordinate the network of separate operations in the flow to achieve a common goal. Integration has because of all this become one of the major challenges within supply chain management. (Schary & Skjoett-Larsen, 2001) The picture of supply chain management as a collaborative concept is confirmed by a study of Gibson *et al.* (2005), where 80 per cent of the respondents thought that customer and supplier collaboration were encompassed by supply chain management.

Siems (2005) describes this as the latest paradigm within supply chain management and argues that information technology have allowed companies to spread its supply chain worldwide. The challenge with supply chain management is to ensure that all entities have information about the other entities in order to be effective and take the right decisions that gain the supply chain as a whole and not just the decision unit. This latter broadened view on the supply chain puts further focus on the necessity to make information appropriately visible for different stakeholders. The total amount of information has increased as processes within the supply chain are being extended and transactions becoming more and more. In order to take correct decisions in general and particularly in the context of supply chain, visibility of the appropriate qualitative and quantitative facts become crucial. Visibility in turn relies on an atmosphere and processes embracing information sharing, and research has shown that certain aspects are of more importance than others to promote information sharing.

4.1.3 Information sharing

Barrat & Oke (2007) conclude that supply chain visibility can be considered as the link between increased supply chain performance and information sharing. Thus, establishing well-functioning information sharing procedures delivering high quality information is a pre-requisite for visibility. Information sharing has also become an important concept within supply chain management and many researchers have tried to find the connection between information sharing and efficient supply chain management. As described earlier, the increased amount of information and the need for sharing information have directed much attention within supply chain management towards information management. The information sharing allows firms to manage the supply chain more efficiently but also to globalize, for example outsource the production to cheap-labour countries. (Siems, 2005)

The importance of information and its relation to the logistics system is described in the article by Closs *et al.* (1997). The article refers to the importance of having the right information at the right time and at the right place. This saying often refers to physical goods but it is as important when looking at information management. While a logistical system converts material into products, the information system converts data into information to facilitate managerial decision making. This leads to the distinction of information and data. Data becomes information when given managerial attention. The information then needs to be used in decision making processes in order to increase the performance of the supply chain. Closs *et al.* (1997) It is also important to identify all antecedents of information sharing in order to successfully be able to implement and gain benefits. (Zhou & Benton Jr., 2007) Not all researchers look at the same antecedents but similarities can be found. (Fawcett *at al.*, 2007; Zhou & Benton Jr., 2007) According to Barrat & Oke (2007), Moberg *et al.* (2002) have concluded in a literature review that:

> *"... only two variables, information quality and relationship commitment were significantly related to strategic information exchange." (Barrat & Oke, 2007, p. 1221)*

Looking at the first variable, *information quality* Zhou & Benton Jr. (2007) make the following definition:

> *"Information quality measures the extent to which information shared between organisations meets the needs of the organisations." (Zhou & Benton Jr., 2007, p. 1351)*

This includes much of which, according to Barrat & Oke (2007), leads to visibility. They claim that if the information is of high quality it should be: accurate, trusted, timely, useful, and in a readily usable format. The organisations could also mean people or functions within a company group.

The other variable, *relationship commitment* is more about inter-firm aspects and thus falls outside the scope of this thesis.

Willingness and *connectivity* are two other aspects reported in literature as being highly significant in the pursuit of excellence within information sharing. Both Fawcett *et al.* (2007) and Closs *et al*. (1997) discuss the importance of these aspects. Fawcett *et al.* (2007) state:

> *"Connectivity creates the capability to share information." (Fawcett et al., 2007, p. 359)*

Many managers have done significant investments in technology to share information and have through this obtained high connectivity. Despite their efforts they have not seen the improved performance that information sharing

is thought to bring. According to research this has to do with the fact that many companies forget the aspect of willingness. One can not only make the information available, the organisation also needs to embrace the concept of information sharing. Only when all these aspects are fulfilled the benefits of information sharing can be obtained. (Fawcett *et al.*, 2007)

4.1.4 Supply chain visibility

As mentioned in chapter 1, there is no generally accepted definition of supply chain visibility. The term though seems to include accessing and providing relevant information within the supply chain. Abbott & Manrodt, as cited in Zhang *et al*. (2008), simply states that visibility is a complex issue that involves people, processes, technology and information flows. Thus, there is a strong connection between visibility and information sharing. Zhang *et al*. (2008) also mean that the different definitions depend on what perspective visibility is viewed from. From an IT perspective, Tahomy (2003), as cited in Goh *et al*. (2009), makes the following definition:

> *"Supply chain visibility is the ability to access or view relevant data or information as it relates to logistics and the supply chain." (Goh et al., 2009, p. 2548)*

From a logistics perspective, John Fontanella argues that supply chain visibility is the transparent view of time, place, status and content.

Further, from a knowledge management perspective, Zhang *et al*. (2008) defines supply chain visibility as:

> *"Supply chain visibility is the ability to provide the latest relevant information/knowledge to all supply chain partners for collaborative decision making" (Zhang et al., 2008, p. 866)*

When choosing the definition for this thesis, the authors finally settled for the definition provided by Goh *et al*. (2009). This definition resembles the one with a knowledge management perspective. It derives from a careful analysis of the currently known definitions and is addressed from the nature of a supply chain professionals' work, which is ultimately decision making:

> *"Supply chain visibility is the capability of a supply chain player to have access to or to provide the required timely information/knowledge about the entities involved in the supply chain from/to relevant supply chain partners for better decision support." (Goh et al. 2009, p. 2549)*

When interpreting this definition into the context of this thesis, some terms need explanation. By *supply chain player* the authors mean an organisation or department within an entity in the company group. The *entities* involved in the supply chain relates not only to entities within the company group but also to customers, external warehouse operators and suppliers. *Supply chain partners* refer to the other supply chain players.

However, visibility can also be divided into one of two types, as described by Zhang *et al.* (2008). *Tactical visibility* is information about for example material flows, finance flows, inventory levels, production capacity and

resources. This information is mostly *quantitative knowledge* and can be acquired from data extracted from business databases. Quantitative knowledge helps when trying to understand business processes or contexts. The other type, *strategic visibility*, is connected to decisions regarding the entire organisation and focuses on relationships and collaborative decision making. By performing collaborative decision making, you gain *quantitative knowledge.* This knowledge is subjective and consists of peoples' experience and judgement which provides insights and opinions for faster and better decisions. (Zhang *et al*., 2008) In this thesis focus will be on increasing the tactical visibility. Hopefully increased strategic visibility will come as a long-term effect of this.

4.2 Impacts of visibility and information sharing

In order to fully understand what have stressed the need for increased information sharing and coordination in a supply chain some effects related to supply chains must be reviewed. This section reviews what impact information sharing might have on a supply chain and the effects that might appear between its actors. The section should further deepen the understanding to why certain concepts are relevant to the thesis.

4.2.1 The bullwhip effect

Distorted, or lack of, information along the supply chain may cause several problems. One problem is big variations in order quantities which amplifies upstream the supply chain, also known as the bullwhip effect. The effect is illustrated in Figure 4.3. Problems related to the bullwhip effect are excessive inventory, poor product forecasts, insufficient or excessive capacity, uncertain production planning and high costs for corrections. *Lee et al.* (2009) have identified four causes of the bullwhip effect: demand forecast updating, order batching, price fluctuation and rationing and shortage gaming.

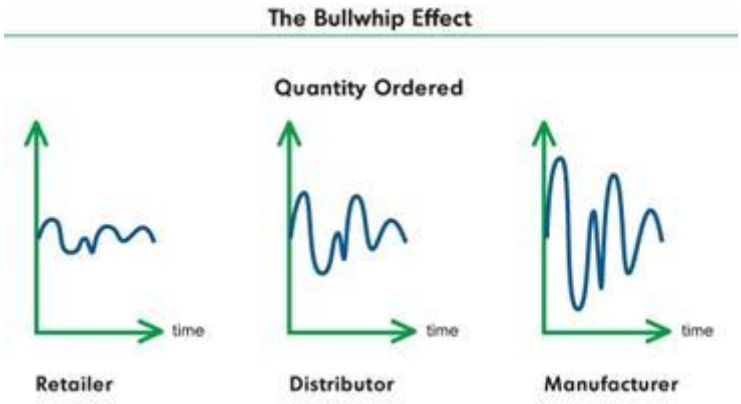


Figure 4.3: The bullwhip effect. Source: itusozluk.com

Demand forecast updating occurs when managers do not only base their forecasts on historical data but also takes order information from the downstream player into consideration. When the order information is processed into the forecasts it also affects the order to the upstream supplier which in turn experience even bigger order variations than the actual demand. These fluctuations get even worse when the lead time is long. *Order batching* affects the order variations in a similar way. A company experiences frequent demand but ordering with the same frequency would require heavy administration and the supplier might not be able to handle as many orders. Because of this, supply chain players tend to batch its orders and accumulate demand before placing an upstream order. The upstream supplier therefore experience great peaks in its demand which contributes to the bullwhip effect. *Price fluctuations* affect the bullwhip effect in a more obvious way. When offered a discount, customers tend to order more than demanded; this leads to inventory piling up. When the prices are back to normal the customers reduces their inventory and order less than demanded. This gives greater variations in the orders that the demand variations. The last cause of bullwhip effect identified is *rationing and shortage gaming*. This occurs when demand

exceeds supply. If the customer knows that it will only get 50 percent of what is ordered, due to rationing from the supplier, it tends to increase its orders. Because of this the orders give the supplier very little information about the real demand. (Lee, Padmanabhan, & Whang, 2009)

To mitigate the bullwhip effect managers need to be aware of what causes it and take actions against behaviour that increases it. One way of mitigation is through better information sharing along the supply chain since lack of information and uninformed decisions can in many cases cause a bullwhip effect. (Lee, Padmanabhan, & Whang, 2009) However, not all bullwhip causes mentioned can be eliminated by better information sharing and visibility. According to Lee *et al.* (2009) demand forecast updating, order batching and shortage gaming can be reduced by different actions aiming at increasing information sharing. Because of this these are also the causes relevant to this thesis.

4.2.2 Other supply chain effects

The previous section discussed the bullwhip effect as significant to supply chains and it was clear why increased information sharing and visibility is needed to be able to affect the inventory levels. However, there are more effects that affect the inventory levels and through this the capitalization.

One very significant effect is the *time lag* regarding demand information that appears and tends to increase the longer the supply chains are. Normally demand information is communicated through orders. However, real demand only appears when the final consumer consumes the products. If the warehouse is refilled once a month and there are several steps between the end consumer and the producer there might be time lag of several month before a change in demand is identified by the producer. Not only get the information delayed, there is also a risk that the information is manipulated

and does not show real demand but the need for warehouse refillment. Also the downstream information regarding deliveries might be breeze in the sense that delivery information often appears through the delivery arriving. This gives the receiving end very little time to react. The time lag affects the information quality in the supply chain and by this the insecurity among the actors. (Mattsson, 2002)

Another logistical aspect is the *flexibility* of a company. Flexibility might include different things such as ability to customize products to market demand, ability to change the product mix, ability to keep in pace with demand fluctuations and ability to change lead times and quantities within the lead time. If a producer have low level of flexibility actors downstream in the supply chain tend to build up safety stock. Flexibility might, as we will see further on, be one of the things that improve with better information sharing and visibility. (Mattsson, 2002)

The *lead time* is another effect that companies need to take into consideration. The lead time might is affected by for example the number of transactions of information or material in a supply chain. With more transactions and a more complex supply chain the lead time tends to increase. With longer lead time bigger orders are required and also the insecurity in the supply chain rises. (Mattsson, 2002)

The effects and aspects of logistic flow described above is just a peek of all what might affect insecurity and lead times in the supply chain. However, it is important to have an understanding of what might affect this in order to be able to decrease the capitalization in a supply chain. A big part of the capitalization is the stock levels. Stock levels are affected both by order quantities and by insecurity. Order quantities increase the buffer stock needed

while insecurities increase the security stock needed all of which affects the capitalization and thereby the cost of distribution. (Mattsson, 2002)

4.2.3 Benefits

The benefits of information sharing and supply chain visibility have been investigated from several scientific aspects. It is difficult to find a distinction between what can be obtained from one or the other. Barrat & Oke (2007) however, make the following statement:

> *"We suggest that the concept of information sharing is not directly linked to that of improved performance." (Barrat & Oke, 2007, p. 1218)*

They further claim that in order to achieve improved performance the information must provide visibility and be used for decision making. This means that potential benefits of information sharing mentioned in literature are depending on the level of visibility. In this thesis the benefits therefore will be reviewed with Barrat & Oke's prerequisites in mind.

One benefit that is often mentioned in the literature is improved responsiveness and flexibility of the supply chain which increases the external performance. (Bartlett *et al.*, 2007; Wei & Wang, 2010; Siems, 2005) Wei & Wang (2010) have found the same benefits and explains how these benefits are shown. They argue that the organisation through good visibility can adapt to changes in its environment and quickly seize new business opportunities as they rise. This is seen as a great advantage in the faster moving environment that companies are operating in today. Another benefit connected to the external performance is increased delivery performance. (Zhou & Benton Jr., 2007; Bartlett *et al.*, 2007; Fawcett *et al.*, 2009) Bartlett *et al.* (2007) connects this benefit to the increased flexibility and responsiveness and claims that this

leads to better market performance. In market performance they include delivery performance, productivity and customer service.

However, there are not only benefits connected to external performance to be found in the literature. Also the internal performance can be improved by information sharing. Fawcett *et al.* (2009) have identified the following benefits: smaller batch sizes, reduced inventory levels, faster new product design, shorter order fulfilment cycles, improved coordination in supply chain activities and improved purchasing operations. These benefits are obtained on a tactical level and the visibility affects the performance directly. Internally, visibility also affects a company's capabilities on a strategic level. Barrat & Oke (2007) have for example found that better information sharing can improve the decision making by enable more informed decisions. Further, Mentzer *et al.* (2004) have found benefits on a strategic level through better planning capabilities.

As described above visibility and information sharing are concepts that might reduce the problems investigated in this thesis. However, there are certain requirements and steps that need to be fulfilled in order to achieve the benefits described. These are reviewed and conceptualized into an analysis model in the following section.

4.3 Conceptualization

The purpose of this section is to develop an analysis model that will be used to answer the research questions. The components of the model are commonly mentioned in literature and are discussed below. Since the concepts discussed in the previous section have very much in common and have connections to each other, the conceptualization will contain theories from different concepts. Related to each component there will also be a number of

propositions that will be evaluated in the case studies. The propositions are based on theory and exploratory interviews at the company and will further help answering the research questions.

4.3.1 Information quality

It has been concluded by Barrat & Oke (2007), Zhou & Benton Jr. (2007), Hartono *et al.* (2010) and Mattsson (2002) among others that information quality is an important aspect in order to achieve successful information sharing and increased visibility. However, different researchers have different opinions on how to judge information quality. The authors have carefully reviewed the literature and found the criteria described by Barrat & Oke (2007) to be both scientifically valid and suitable for the purposes of this thesis. According to Barrat & Oke (2007), in order to achieve visibility the information shared needs to be accurate, trusted, timely, useful and in readily usable format. They do not however define the criteria themselves so definitions of each criterion found below are based on Bailey & Pearson's article from 1983 and Mattsson (2002). It is also important to judge these criteria through the eyes of the recipient, since it is that person who will use the information.

Accuracy is defined as the exactness of the output information. A high level of accuracy means that the information is exact and has not been altered along the way, e.g. by any IT-system. In the company case, it's important to investigate whether the data in the ERP-system reflects the reality, e.g. does the physical inventory really contain as much paper as the ERP-system claims?

Trustiness is defined as the consistency and dependability of the output information. If the information source is dependably the more likely it is for the information to be dependable. It is also important that the information is consistent, i.e. the source provides the same result every time.

Timeliness is defined as the availability of the output information at a time suitable for its use. This means that the information must be available and recent when using it. This criterion will be judged differently depending on what information it concerns. For example, stock levels might be needed to update in real-time while an update of the company's customer base only is needed when getting a new customer.

Usefulness is defined as the degree of congruence between what the decision-maker requires to make good decisions and what is provided by the information source. If for example the decision-maker is planning on making a purchase of a transport service, information regarding routes and distances can be considered as useful while information about raw material prices most probably cannot.

Readily usable format is defined as the degree of how understandable the format of the output information is to the recipient. If the information is not understandable it cannot be assimilated. For example, if the ERP-system cannot present the data in an understandable way, this criterion is not fulfilled.

Based on the above mentioned the following propositions regarding information quality have been made:

P1: *"Inventory levels cannot be decreased by improved information quality regarding order forecasts from the customers."*
P2: *"Inventory levels cannot be decreased by improved information quality in the communication between customer service centres and mills."*
P3: "*Left-over inventory cannot be reduced by improved information quality at the customer service centres."*

4.3.2 Enablers

The enablers of information sharing and visibility are many and different depending on whom you ask. Collaboration and communication are diligently mentioned in research as well as connectivity (Zhou & Benton Jr., 2007; Closs, Goldsby, & Clinton, 1997). Most research speaks of connectivity as the technical capability to share information, e.g. with IT-systems. However, according to Barrat & Oke (2007) technical connectivity is not enough to achieve visibility since it does not take behavioural and people issues into consideration. Further, Fawcett *et al.* (2007) state:

> *"Technology is too often viewed as the answer rather than as an enabler." (Fawcett et al., 2007, p. 367)*

This is why connectivity in this thesis is seen in a broader context along with other, non-technological, methods for communicating and collaborating represents the *enablers* of visibility. The non-technological enablers could be for example meetings or personal relationships which allows for an exchange of information. Barrat & Oke (2007) have conducted case studies at different companies and found for example face-to-face meetings, phone and mail conversations and different job functions to be non-technological enablers of visibility. As technological enablers they identified collaborative planning systems, web-based EDI:s, fax and e-mails.

Mattsson (2002) mentions the same enablers that have been identified by Barrat & Oke (2007). However, in his book he also discusses some differences and when certain enablers are more suitable than others. First of all, he makes a distinction between spontaneous information sharing and routine based information sharing. Spontaneous information sharing occurs unplanned. Either it is unplanned in terms of when it occurs or it is unplanned in terms of

what it concerns. The spontaneous information sharing might be urgent and this is often the case when it concerns status updates regarding orders or inventory. When information sharing is spontaneous it is often man-to-man communication and enablers like telephone, e-mail or fax is suitable. It might also be man-to-system and in these cases the enabler is obvious. Spontaneous information sharing is more costly than routine based and the cost increases with the frequency of the communication. Spontaneous information sharing with high frequency is beneficial to plan and maybe other enablers might then also be more useful. In planned communication all enablers might be useful but the higher frequency and the more people in need of the information technical enablers like EDI-system are more suitable. (Mattsson, 2002)

If many enablers can be identified the process of increasing visibility will be facilitated. These enablers are in a sense also requirements because without them there will be no capability for sharing information. In this thesis focus will be on investigating the ERP-system which is used by almost all administrative staff at the company. Other existing systems will also be investigated as well as the possibilities of using new systems and software like MapPoint.

Based on the above mentioned the following propositions regarding enablers have been made:

P4: *"All information needed to provide visibility in the supply chain can be found in the ERP-system."*
P5: *"The ERP-system does provide information of sufficient quality to achieve visibility."*
P6: *"A software tool cannot help increase the visibility at the company."*

4.3.3 Organisational aspects

Organisational culture affects information sharing in many ways (McKinnon *et al.,* 2003). Willingness to share information could be considered to be one of the more obvious parameters and it is required that people are willing to share information in order to obtain information sharing. There are different aspects of willingness connected to information sharing. People from different organisations may be unwilling to share information with each other in fear of losing competitiveness. Regardless whether this is a real threat or not, this unwillingness can be a big problem. (Fawcett *et al.*, 2007)

Another aspect of willingness is how the organisational culture affects the willingness to share information with colleagues. This aspect has very much to do with psychological issues within organisational theory. Researchers have tried to find out what affects an individual's willingness to share information and the results imply that both the individual's bonds to the organisation as well as its personal believes are of significance. (Constant *et al.*, 1994) Also organisational culture might affect willingness and in order to achieve efficient information sharing companies need to have clear policies regarding information sharing and a culture that encourages collaboration and sharing within the organisation. The importance of managers supporting information sharing is also underlined. (Constant *et al.*, 1994; McKinnon *et al.*, 2003) The need for information sharing has been more highlighted in the past years and much research has focused on the importance of willingness. (Fawcett *et al.*, 2009)

When information is shared it needs to be used in the daily decision making. Not much research has been done on how this is enabled but Barrat & Oke (2007) describes this as a prerequisite to gain benefits by increased supply

chain visibility. They claim that it is the more informed decisions, made possible through information sharing, that lead to improved performance.
Another aspect that concerns the organisation is the company structure. As discussed in the frame of reference there are a few structural prerequisites for successful information sharing. First, the communication needs to be between members of the same business process regardless of function or location. This require for customers service centres to communicate with mills and customers because of them belonging to the same business process. Another thing that is important to avoid sub-optimizations etc. is to establish common goals. It is important to investigate whether the different departments at the company have the same goals when it comes to inventory levels.

The organisational culture is an important aspect of information sharing and visibility and will of course be investigated in this thesis. In the analysis, the organisational culture will be considered in two ways. First it need to be investigated whether information is shared or not and if the possible lack of information sharing can be derived from unwillingness among staff. If information is shared the thesis will seek answer to whether the information is incorporated in the daily decision making. Based on this and the above mentioned theory the following propositions have been made:

P7: *"The managerial support on collaboration and information sharing within the company is sufficient."*
P8: *"There is a willingness among staff members to share information within the company."*
P9: *"Information made available through information sharing is used by staff in their daily decisions."*

4.3.4

4.3.5 Analysis model

Based on the literature study the analysis model illustrated in Figure 4.4 has been developed. The model shows how increased supply chain performance can be achieved through visibility. The cornerstone of the model though is information sharing due to the fact that most research view visibility as a component of successful information sharing. However, other prerequisites have also been found in literature. First, in order to achieve visibility, the information must have a certain level of quality. This aspect is judged by five criteria, namely: accuracy, trustiness, timeliness, usefulness and readily usable format. Second, if these are fulfilled a company also needs to use that information when making decisions. This requires an embracing organisational culture. Last, in addition to those two aspects, enablers are also needed to facilitate the processes. Enablers can be either technological or non-technological, such as personal meetings.

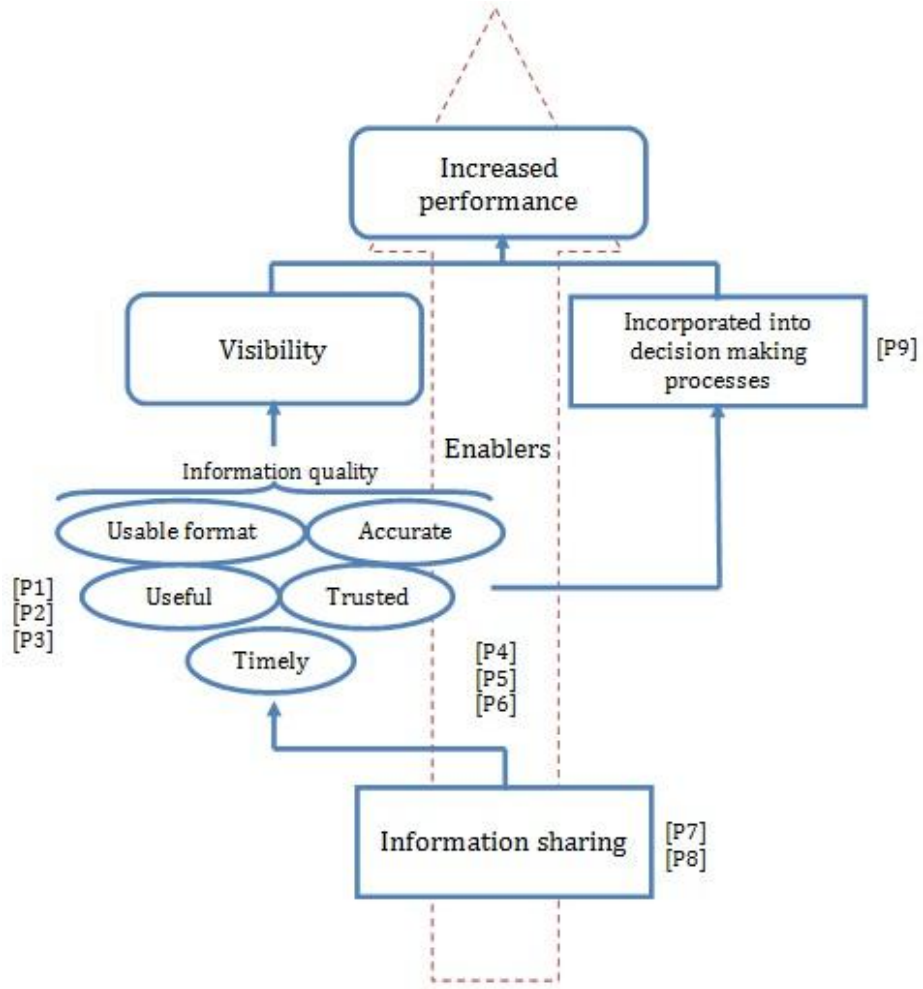


Figure 4.4: The analysis model: Supply chain visibility from a broader perspective - The prerequisites of increased performance by information sharing.

When conducting case studies at the company, the analysis model will be used to evaluate each step in the sales process to find answers to the research questions and propositions. It is, as mentioned earlier, in this process the activities that due to bad information sharing or visibility could affect the inventory levels. This makes it the process interesting to test against our analysis model. Below, Figure 4.5 explains where information sharing occurs in the sales process and this is what is interesting for the study. Information is

generated and shared both within and between the different activities in the sales process. The study will first of all see if all information needed is shared and then evaluate the share information using the analysis model presented in Figure 4.4.

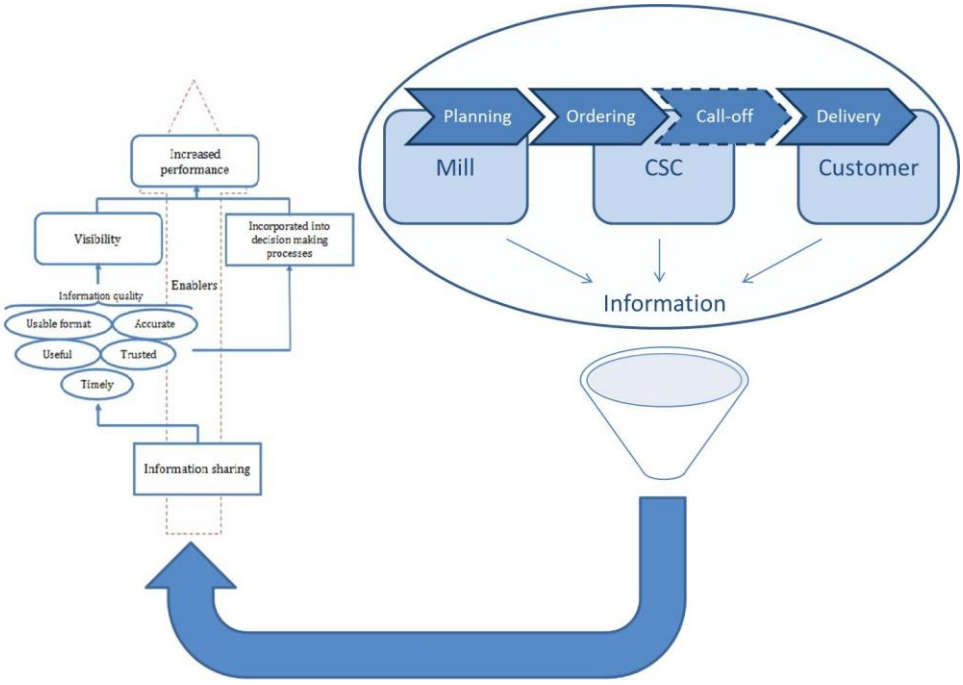


Figure 4.5: The aim of the analysis of the sales process

5 Empirical findings

In this chapter the empirical findings from the three case studies will be presented. The chapter is meant to present findings that are relevant for the analysis and to give a clear picture of the current situation at the company. Each case is first presented isolated and the chapter concludes some general findings and a summary of the information flow.

Although the company aims at having the same organisational structure and sales process for each of the segments that are represented in the case studies (newsprint, fine paper and carton board), some deviations may appear. The sales process has been described earlier but interesting findings from the cases will be presented in three case specific sections. These sections focus on the criteria of the analysis model. The general discussion highlights some interesting differences between the three cases and presents other general findings.

5.1 The newsprint case

The following section gives a description of the newsprint segment followed by a presentation of the findings connected to the analysis model. The findings are also summarized in Table 5.1.

Newsprint is one of business area 1s two BUs as shown in Figure 2.1. The BUs each represents about 50% of the BA's total capacity. Within the newsprint case a wide range of paper qualities are handled but similarities between the products can be found. Most of the products are very standardized in terms of paper quality and same qualities are offered by a range of competitors. The paper is delivered on reel to the customer. The variety among paper qualities and the fact that almost all customers have different needs when it comes to

core, reel diameter and width makes the orders very customized. Most production is order based and most orders are dedicated to a certain customer already at production. (Andersson, 2010)

The customers are publishers, advertisers and printing houses. Often these are parts of bigger company groups which buy big amounts of paper. The customers often handle a variety of specifications within one paper quality and often have difficulties in predicting exactly how much is needed of each specification in the near future. Often the customers use several suppliers and their demand towards the company is therefore fluctuating. (Andersson, 2010)

The company owns the paper and pays the warehousing cost until the final delivery to the customer. Within newsprint the paper cannot be stored for an unlimited amount of time but gets too old after 90 days in stock. If the paper has not been delivered and sold before this it becomes waste. (Andersson, 2010)

The customers are served by the BA's three CSCs. As mentioned earlier the newsprint products are not unique which means that the main competition is within service and price. This in combination with supply exceeding demand creates a market situation where the customer is quite powerful. Efforts have been made by reducing capacity in order to balance the market. Still the customer is quite powerful though. (Andersson, 2010)

5.1.1 Information quality

The information quality within the newsprint sales process is fulfilling most of the quality criteria. The main problem is the information from the customers which sometimes not is of the right quality. It might be hard for some customers to predict their need of paper and specify exactly what they will

need. This is one of the reasons to why there sometimes are left-overs in stock when an order is totally delivered. This is not a problem when the specification is recurrent and the paper has not been in stock for too long but in some cases this is a problem. Mainly it is the forecasts in terms of call-off specifications and demand information that is experienced to be of bad accuracy. This is a problem since a big part of the orders handled are call-off orders. Since the information then is used for other information sharing the problem spreads throughout the sales process. However, it is not believed possible to improve the information quality from the customers since the customers themselves get very little information and have very hard to predict their demand. (Deppe, 2010)

Internally it is especially the sales plans that are interesting. The mills and CSCs tend to have different focus and this is why the mills do not feel they are accurate. The sales plans are not accurate until the time it is locked for editing, i.e. the 25th the month before. The late update of the final sales plan leads to the CSCs experience that the quota is not as timely as it should be since the mills base the quota partly on sales plans. When discussing sales plans and quota it is also obvious that the CSCs and mills have different views on what can be considered accurate and timely which is one of the reasons to why they are considered to be of bad quality. (Erbach & Preis, 2010; Carlsson, 2010)

The other great issue internally is the information regarding delays from the mills. The information about unplanned stops in the machines or transportation problem that cause delays is not said to be very timely. The CSC also feels that this might lead to customers exaggerating their orders due to uncertainties. (Erbach & Preis, 2010)

5.1.2 Enablers

The main enabler for information sharing is the ERP-system. It is overall considered to be a very good tool where most information is by the interviewees found to be in a both accurate and readily usable format. Except from the ERP-system, phone and e-mail are the main enablers. Also these are considered to enable good information sharing between the supply chain players. Most of the information sharing with phone and e-mail is very spontaneous and the information exchange is very frequent. Mainly it is information that is not available in the ERP-system that is exchanged but sometimes also this kind of information is communicated through e-mail or phone. (Erbach & Preis, 2010; Carlsson, 2010)

Except from the technical enablers the newsprint segment also has routines for stock monitoring at the CSC level. They continuously monitor the stock and look for left-overs and check the stock levels before a new order is placed. (Erbach & Preis, 2010)

5.1.3 Organisational aspects

The organisation is overall very willing to share and use information available. All employees working in the sales process view the other as colleagues rather than competitors. This creates a culture where information is not protected but shared and also information that is available is used. (Carlsson, 2010; Erbach & Preis, 2010)

Sometimes there are uncertainties about what information to use and share. There do not seem to be very much fixed routines and templates on how this should be handled. The information sharing therefore varies between depending on what mill or what person is responsible. One example of this is that there at some CSCs there are formal routines for continuously monitoring inventory levels but for some it is based more on personal initiatives. The way

of working with monitoring varies a lot but seems to be a common goal for the entire organization. The company puts much effort in creating target levels for inventory levels but these might not always be communicated to the right people. (Carlsson, 2010; Erbach & Preis, 2010)

5.2 The carton board case

The carton board case is very similar to the newsprint case in terms of how the sales process works. The greatest similarity is that both segments handle quite a lot of call-off orders. What differs is that the carton board segment handles much smaller quantities in each order. Below the characteristics found is described and are summarized in Table 5.2.

Cartoon board is part of the business unit B which in turn is one of two BUs within business area 3. Of carton board 60 per cent is cigarette packaging and the rest is evenly divided between media packaging and general packaging. The company do only produce the packaging material and never do any graphic printing or finished packages. Carton board differs from the two other cases in the sense that their products are not that standardized. Depending on what machine produces the material there are major differences in terms of quality and other characteristics. Although just as the other cases the paper is delivered very customer specific when it comes to core, reel diameter and width. (Rudström, 2010)

The customers are on one hand major producers of for example cigarettes or printing houses producing packages for big brand owners. These printing houses often have a quite difficult situation since they are middle sized printing houses squeezed between big material suppliers like the company and big brand owners. Carton board can just as newsprint get too old, the age differs between one to two years. Just as in all cases, the company pays the

warehousing cost and owns the stock. Carton board has the same contracts as fine paper and the customer gets invoiced after 60 days and depending on the contract it have to pay warehousing costs as well after this time. With beginning of 2011 this fee have been increased and from then the customers will be charged 10€ per ton and month. (Rudström, 2010)

Packaging have six CSCs, which serves the carton board customers, where one is specialized in just cigarette packaging. Cigarette packaging differs a bit from the other product types by the fact that they do not have any field sales but the super sales persons are placed at the mills and negotiate contracts directly with the customers. As mentioned previously carton board is a more differentiated business and competition is not only about price and service but a big part is also the quality. If a customer demands high quality products they are also prepared to pay for this. (Rudström, 2010)

5.2.1 Information quality

There were not very much problems concerning the information quality found in the carton board case. Unlike the newsprint case, the demand information from the customers is by the interviewed staff said to be good. The only information that is not of sufficient quality is the quota. It is divided segment wise and not as in other segments, market wise. This makes it difficult for the employees at the CSCs to divide the quota between their customers. The situation might affect the distribution of capacity so that the ones that need paper do not get enough while others get too much capacity. (Popowski, 2010; Rudström, 2010)

Also CSCs request more information regarding unplanned production stops and delays at the mills. Since it is the CSCs that communicate with the

customers, lack of this information might lead to the customers not being notified in time. (Popowski, 2010)

5.2.2 Enablers

Just as in the other cases the main technical enabler is the ERP-system. The same information as in the other segments is available through the system. Also phone and e-mail is used regularly to exchange information between CSCs and mill and also CSCs and customers. This information sharing is of a very spontaneous art even if it is done frequently. (Popowski, 2010)

No particular non-technical enablers, as for example special routines, have been found except that the stock situation is regularly monitored. However, regular meetings among managers do occur and information is here exchanged. These types of meetings have also been requested by operational staff in order to increase the understanding and knowledge of the process. (Popowski, 2010)

5.2.3 Organisational aspects

There is a clear willingness both to share and to use information available. Also the staff express a willingness to get even more cooperation with colleagues from other departments in order to exchange experiences and information. There is also a demand from staff of more routines even if the responsibilities in carton board seem more clear than in for example newsprint. (Popowski, 2010)

The managers support information sharing and are positive to cooperation between the departments in the sales process. Also there is a big awareness of the warehousing problems and the segments seem to be pretty open to new ideas in order to get better processes. (Rudström, 2010)

5.3 The fine paper case

The fine paper case differs a bit from the two others. This mainly has to do with the fact that the order structure is a bit different and not at all as many orders are call-off orders. Also products are made customer specific in a later stage of the process which creates a good flexibility. The findings are summarized in Table 5.3 and reviewed below.

The product segment in the fine paper case consists of high quality graphic paper and office paper. Graphic paper is used in high quality publications and office paper might be for example printing paper and paper for envelopes.

Just as within newsprint the products are quite standardized but they are customized by for example different covering sheet depending on the customer. The orders do get customer specific in a later phase than in for example newsprint and the production is therefore more flexible. The company also has its own brands of standard products. Unlike publication paper most of fine paper's products are delivered and ordered by pallets and not by reel even if reels are delivered as well. (Järbur, 2010)

Their customers are merchants, envelope converters, office suppliers and office equipment producers. The company's customers are big companies which might supply smaller wholesalers. The demand is often predictable and the buyers are well aware of what they will need when placing an order. (Järbur, 2010)

Another similarity between newsprint and fine paper is that the company owns the inventory and pays warehousing costs until the paper is delivered to the customer. The difference compared to newsprint is that fine paper does not get too old. The company's contract with the customers also limits the

time the paper is held in stock to 60 days. After that the paper is automatically invoiced. (Järbur, 2010)

5.3.1 Information quality

Just as in the newsprint case the information from the customers, going in to the sales process, is by the interviewees not perceived as very accurate. Their demand prediction is not as accurate as needed and this in turn affects the accuracy of the sales plan. However, the information quality in this case is not as important as in the other cases since fine paper their own forecasting system. Their forecasts partly eliminate the need of good and accurate forecasts from customers. (Bremberg, 2010; Sandberg, 2010)

Also in the fine paper case the information regarding delays is considered to be of bad quality. The main problem is the timeliness of the information and often the customers inform about delays before the mills do it. The information about planned production stops is however considered to be good. (Bremberg, 2010)

5.3.2 Enablers

The main enablers are the same as found in the other cases. The ERP-system, e-mail and phone are the most frequently used enablers. Also in this case the information sharing through e-mail and phone is very spontaneous but still very frequent. The information quality from the ERP-system is by the interviewees considered to be good and is said to be both accurate and in a readily usable format. In the fine paper case there are also some additional technical enablers to be found. One of these is TOPSY which is used in one of the mills for the hauliers to know when the paper is ready to be loaded. Whether this system is an enabler for information sharing within the sales process can however be discussed. Some mills have another technical tool which alerts if an order is late in production. This is not an enabler for

information sharing but it helps the mills who are using it to give more timely information to the CSCs. (Bremberg, 2010)

No special non-technical enablers have been found in fine paper. There is also no request for this kind of non-technical enablers like meetings or clear routines. (Bremberg, 2010)

5.3.3 Organisational aspects

The willingness both to share and use information is strong also in the fine paper case. Most of the staff experiences the cooperation with the other departments and with the customers to be working well. Also the management are very supportive and open to new ideas and also positive to information sharing. (Järbur, 2010)

The main problem within fine paper is, as also found in the other cases, the lack of routines in some cases. The delay information was as earlier mentioned not very timely but this varies a lot between different mills which have to do with the absence of general guidelines. Also, some find it hard to know what information to use and what to share due to unclear responsibilities. Much of the routines concerning stock monitoring are very individual. (Bremberg, 2010)

5.4 General findings and summary

Below, three tables summarizing the information sharing between the supply chain players within each segment investigated are presented. This will be followed by a short review of some general findings that have turned up during the empirical investigation. Whether the bullets presented in the tables are correct is at this point only assumptions and will be reviewed more carefully in the analysis chapter.

Information sharing within the newsprint sales process.						
	Information sharing			**Enablers**	**Information quality**	**Organisational aspects**
Supply chain player	Available information	Information shared (downstream)	Information shared (upstream)	Enablers	Information quality	Incorporation into decision making processes
Customer	Demand	N/A	• Orders • Call-offs • Forecasts	• E-mail • Phone	• Accuracy of forecasts vary a lot • Call-off are rarely specified • Demand are hard to determine	N/A
CSC (Field sales and sales desk)	• Customer forecasts • Historical sales and call-off data • Customer contracts • Inventory data	• Delivery information • Delivery delays • Dialogue about order and delivery changes • Order verifications	• Sales plan • Order information • Order change requests • Quota change	• E-mail • Phone • ERP-system • Routines for stock level monitoring	• Inventory data from the ERP-system sometimes suffers from lack of accuracy • Perceived level of accuracy regarding sales plans vary a lot • Timeliness of sales plans is poor and accuracy vary	• Stock levels monitored and taken into consideration before placing an order and is used to find left-over stock • Historical call-off pattern is used when placing orders • Customer forecasts and historical sales data are used to make sales plans

	• Quota • Order information		requests			• Quota is used to plan orders
Mill	• Sales plans • Order information • Inventory data • Transport information • Production plan • Production and transport delays	• Production and transport delays • Planned production stops • Quota • Delivery information • Order and quota changes	N/A	• E-mail • Phone • ERP-system • Mill production system	• Quota is not very timely and can be perceived as confusing • Timeliness regarding delays vary a lot between mills and is sometimes absent	• Sales plans are used to make quota • Stock levels are monitored and actions are taken if needed

Table 5.1: Information sharing within the newsprint sales process.

Information sharing within the carton board sales process.						
	Information sharing			**Enablers**	**Information quality**	**Organisational aspects**
Supply chain player	Available information	Information shared (downstream)	Information shared (upstream)	Enablers	Information quality	Incorporation into decision making processes
Customer	Demand	N/A	• Orders • Call-offs	• E-mail • Phone	• Accuracy of call-offs is perceived as quite good	N/A
CSC (Field sales and sales desk)	• Customer forecasts • Historical sales data • Customer contracts • Inventory data • Quota • Order information • Customer	• Delivery information • Order verifications • Dialogue about order and delivery changes	• Sales plan • Order information	• E-mail • Phone • ERP-system • Outlook • Management meetings	• Some information about customers are stored in Outlook and is not accessible by the mills	• Sales plans are not accurate and are based on yearly predictions by the customers • Sales plans are not very timely • Much information about customers • Data in the ERP-system could be more reliable

	data					
Mill	• Sales plans • Order information • Inventory data • Transport information • Production plan • Production and transport delays	• Production and transport delays • Quota • Planned production stops	N/A	• E-mail • Phone • ERP-system	• The quota can sometimes be confusing whether a geographical or a segment market is meant	• Inventory data is used to monitor the stock levels

Table 5.2: Information sharing within the carton board sales process.

Information sharing within the fine paper sales process.						
	Information sharing			**Enablers**	**Information quality**	**Organisational aspects**
Supply chain player	Available information	Information shared (downstream)	Information shared (upstream)	Enablers	Information quality	Incorporation into decision making processes
Customer	Demand	N/A	• Orders • Forecasts	• E-mail • Phone	• Customer forecasts are not very accurate and therefore not very useful	N/A
CSC (Field sales and sales desk)	• Customer forecasts • Historical sales data • Customer contracts • Inventory data • Quota • Order information	• Delivery information • Order verifications • Dialogue about order and delivery changes	• Sales plan • Order information	• E-mail • Phone • ERP-system • Mill production system • System for indicating late orders • Partnerweb • Personal initiatives for	• Sales plans are not very accurate	• Customer forecasts are used to make rough sales plans • Inventory data is used to monitor the stock levels to some extent

	• Customer data			various tasks		
Mill	• Sales plans • Order information • Inventory data • Transport information • Production plan • Production and transport delays	• Production and transport delays • Quota • Delivery information	• Production and order information through TOPSY to the transporters	• E-mail • Phone • ERP-system • System for forecasting based on historical data • TOPSY, for connecting transporters to the production system • Mill production system	• Information about delays is not perceived to be very accurate nor timely. Planned production stops are communicated while unplanned stops are not.	• Inventory data is used to monitor the stock levels • Historical sales data is used to a greater extent than sales plans to plan for future production • Sales plans are used for more rough estimations

Table 5.3: Information sharing within the fine paper sales process.

When looking at these tables one must not forget the difference between spontaneous and routine based information sharing. In many cases, especially at the CSCs, communication and information sharing are often spontaneous and based on personal initiatives. A lack of formal routines for exchanging information is however relatively consistent for all supply chain players. Some staff members have expressed the need and willingness to have regular meetings with administrators and management from different parts of the organisation.

Another thing to note is that the information available seems to be quite similar for the supply chain players independent of segment. This of course raises questions about why the performance and outcome differs. One answer to this is that the market situation is different for each segment. However, there might be other explanations that will be discussed more in detail in the analysis chapter. Other noticeable differences are that fine paper has more enablers than other segments and newsprint is the segment with the most established routines.

Overall, staff seem very satisfied with the current ERP-system. This system is the most common among staff and it shows the same exact figures for everyone using it which is very useful. In some places other applications are used such as partnerweb and the TOPSY system. To bring in other applications is seen by many as a negative thing due to the fact that it will require some efforts to learn how to use them. When suggesting the MapPoint application to staff the general opinion was that it could be a nice tool for illustrating things but would not be enough to base decisions on.

When interviewing the sales coordinators at the CSCs it seems like they are only responsible of inventory that is stored in external, or contracted,

warehouses and not at the mill warehouses even if they are responsible of the current customer.

An important finding is that many of the people interviewed are aware of the current problems but are not convinced that there are any solutions or are uncertain about whose responsibility it is to find them. A strong belief that it is hard or impossible to change the market situation or business traditions could also be noted.

Another thing worth mentioning is that the fine paper mill investigated in this thesis, seems to be unique in some areas. They have the TOPSY system for transporters to book their own deliveries and a system for creating forecasts by using historical sales data, both of which are perceived to be successful. They also work a lot more with article based orders instead of customer specific orders. The difference is that a customer specific order is tied to a customer and can be hard to re-allocate to another customer if needed. At the fine paper mill, almost every order gets a new article number. This still means that an order is tied to a specific customer but several customers can order the same article since the article numbers are being stored. This allows for a better sales follow-up and easier re-allocation of orders. The implementation of such article based order system can of course be easier if the products are more standardized which is the case at this mill. The mill also does not work with external warehouses but only uses a large warehouse at the mill. This means that they only use direct deliveries and no call-off orders. All above mentioned special circumstances at the fine paper mill will be kept in mind when analysing the situation of the fine paper segment.

6 Case results and analysis

In this chapter the findings connected to each proposition along with a discussion regarding each case will be presented. Based on the results from each case a cross-case analysis will be presented. Here, comparisons and generalizations between the different cases are discussed.

Before continuing to the case presentation, some aspects need to be illuminated. The authors are aware of that the selected study objects (mills, CSCs and the staff) in each case might not be a good representation of the business segment. For example, as concluded in the previous chapter, the fine paper mill is unique in many ways. The authors will bare this in mind but questions have also been asked to underline the differences between special cases and the general situation.

The propositions developed in the previous chapter are repeated below:

P1: *"Inventory levels cannot be decreased by improved information quality regarding order forecasts from the customers."*

P2: *"Inventory levels cannot be decreased by improved information quality in the communication between customer service centres and mills."*

P3: "*Left-over inventory cannot be reduced by improved information quality at the customer service centres."*

P4: *"All information needed to provide visibility in the supply chain can be found in the ERP-system."*

P5: *"The ERP-system does provide information of sufficient quality to achieve visibility."*

P6: *"A software tool cannot help increase the visibility at the company."*

P7: *"The managerial support on collaboration and information sharing within the company is sufficient."*

P8: *"There is a willingness among staff members to share information within the company."*
P9: *"Information made available through information sharing is used by staff in their daily decisions."*

6.1 The newsprint case

Newsprint is a segment with very standardized products but still very customized orders due to different reel dimensions. As discussed in previous sections customers have very difficult to predict their demand of each specification and also the customers are relatively powerful on the market. A big share of the orders are call-off orders which requires good forecasts from the ones placing orders to avoid paper being warehoused for too long. With call-off orders the risk of left-overs also rises.

6.1.1 Information quality

Overall the information quality is perceived as quite good. The number one information quality problem is the customers demand information. The bad accuracy of the customers demand predictions propagates throughout the supply chain and affects the information quality of both sales plans and orders.

Sales plan could according to the mills be of better accuracy and also the quality of the sales plan varies a lot depending on what market it concerns. The CSCs and especially the field sales are on the other hand happy with the accuracy. The mismatch between the different departments' view is here revealed. While the CSC and field sales look at the accuracy for the coming month it is considered good. Since the sales plan might be edited until the 25th the month before, the CSC uses this possibility and makes sure that the sales plan ends up with very good accuracy. The mills on the other hand look beyond the coming month when placing quota and roughly plan production. Since the sales plan two month ahead is quite far from final the mills experience the sales plan to be of less accuracy than requested.

The problems with different views on what to focus on are also to be found when discussing the quota. The CSC believes that their work would be easier if the quota was set earlier than today. However, to be able to set the quota the mills and the master planners need to have a better sales plan for a longer period ahead. Probably the information quality regarding the sales plan and quota would be perceived as better if the concerned departments decided how the information should be used and when it is needed in order to fulfil its purpose. This study have found indications showing that the information today is not shared as timely as it could be in order to be an as helpful tool as it could be.

However, no matter how important both the information quality regarding the quota and the sales plan are none of the two affects the inventory as direct as the actual orders. The orders are the single most important information exchange between the CSCs and the mills. All information needed to fulfil the customers' request is provided through the orders. If the order would state a delivery date earlier than actual needed it will lead to unnecessary warehousing costs and if the order would state a delivery date that is too late it might lead to additional transport cost. Misleading quantities in the orders are also one of the reasons to left-overs. However, it is important to remember that this almost only concerns call-off orders. Also, in order to make the information in the orders more accurate, better demand information must be shared from the customers. In the cases when the customers only specifies what quantities they will need the following month and not when and of which dimensions, it is of course very hard for the customer service coordinators to put in orders that are accurate.

One way of solving this, and that is used within both fine paper and cartoon board, is that the paper is automatically invoiced after 60 days in stock. Within

cartoon board the warehousing cost plus an extra fee is charged the customer for all the time in warehouse that exceeds these 60 days. With beginning of 2011 this fee have been increased and from then the customers will be charged 10€ per ton and month. The system with pre-delivery invoicing if the paper is not called-off is however said to be impossible to implement within newsprint. The customers simply would not accept it.

Another way of getting more accurate orders is to make sure that the information regarding delays from the mill is timelier. The CSCs have noted that customers tend to exaggerate their orders if they experience insecurities in the deliveries. Some mills are better than others in providing timely information when a delay occurs. It would probably be of great help if there were routines of informing concerned parties about delays.

Based on the above discussion proposition *P1* and *P2* are rejected in the case of newsprint. The information quality regarding delays needs to be improved from the mills and improved information quality regarding demand might help decreasing the inventory levels. The timeliness of both the sales plan and the quota could also be improved to serve its purpose better.

Another aspect of information quality that was investigated was the information quality provided by the ERP-system. Some interviewees have indicated that there might be a mismatch between the figures in the ERP-system and the real inventory. However, this is the case in most IT systems and overall the information quality is considered good. The background to proposition *P3* was that the information regarding left-overs maybe was not in a usable format. This has been proven wrong and most users find it easy to identify left-over inventory in the ERP-system. To some extent better demand

information might help reducing left-overs but overall *P3* is considered to be confirmed.

6.1.2 Enablers

The main technological enabler for information sharing within the company is their ERP-system. The system provides most of the information used in the daily work and overall the information provided fulfils the criteria to achieve visibility. However, some information that might be useful for most supply chain players cannot be found in the ERP-system, for example information regarding delays. To the extent of which this information is shared, other enablers like phone and e-mail are used. Based on the fact that other enablers than the ERP-system actually are used and the fact that crucial information cannot be found in the system, proposition *P4* has to be rejected. The ERP-system by itself does not provide visibility to the supply chain. The following proposition, *P5*, on which already been touched upon is considered to be confirmed. All interviewees working with the ERP-system are happy with its functionality and the information provided is of sufficient quality.

Based on the initial suspicions that the ERP-system did not provide enough information quality P6 was developed to find out whether another software tool, like for example MapPoint, could be useful. Just the fact that the ERP-system obviously provides good information quality indicates that another tool would be useless. This is also confirmed by the interviewees of whom all believes that another tool would just increase their workload and add on to the complexity without providing any benefit. Another tool would also have to collect all the data from the ERP-system and its only use would be if it could present the data in a more usable format. The data collected from the ERP-system have showed to be difficult to transfer into other software and it requires quite a workload. This further adds on to the requirements of other software to be really usable and to present data in a more usable way.

However, interviewees agree that the way the data is presented in the ERP-system is usable and very easy to work with. Based on all this, proposition *P6* is confirmed.

To summarize, all technical enablers needed are in place in order to achieve visibility. Most of the information is shared through the ERP-system and additional information is shared through traditional communication like phone and e-mail. However, most of the information sharing through phone and e-mail is spontaneous. This is more costly and time consuming that routine based information sharing. Since much of the information exchanged spontaneously is recurrent it could be beneficial to have more enablers like monthly or weekly meetings and by this make more of the information sharing routine based. Enablers like meetings are more common among on the strategic level and in the planning process but is not very common on the tactical level and in the daily work. The new organisation has also centralized some tasks that were previously done by the mill and this might increase the spontaneous information sharing if not more routines for information sharing are initialized.

6.1.3 Organisational aspects

Overall the organizational culture is encouraging collaboration quite well. This probably has to do with the fact that the information is shared within a firm and most people access the same information. The staff seems to view the other supply chain players as colleagues and not competitors and is aware that they share the same goals. In the cases when the information sharing does not work as well as required this often has to do with lack of routines. People simply forget to share new information as they get it. As mentioned in the previous section, meetings could help encourage the information sharing and also increase the understanding of other departments' situation. To do this there need to be even more support from managers and they need to address

these questions in order for the staff to be more aware of the information sharing. The managers could also increase the awareness and knowledge of how the different players work in order for staff to get a better idea of what information need to be shared. Another thing that has been noted is that target levels for inventory sometimes is set up by managers but is not in all cases communicated to all people concerned. This might lead to some experience problems while another is not aware of it since the person is not aware of the target levels. Also in these cases better routines is needed through better support from managers. Based on this, proposition *P7* is rejected and the managerial support needs to be improved to achieve even better information sharing.

As mentioned it has been difficult to discover any unwillingness to share information among the interviewees. As long as it is clear why the information needs to be shared and how it should be shared people try to share information. Proposition *P8* is therefore confirmed and the willingness among staff is not seen as a barrier to information sharing.

Regarding the last proposition, *P9*, the staff members seem use the information available. However, sometimes the lack of standard routines make the staff unsecure of whether it is their responsible to act on certain information or not. Also, in some cases it is very individual to what extent information is used. For example; whether historical call-off pattern is used to divide monthly orders depends very much on the experience and personal knowledge of the sales coordinator. To sum up; the information is used but with more clear routines and a clear responsibility distribution even more information could be used and in a more efficient way. However, proposition *P9* is confirmed but could be improved in order to increase the performance even more.

6.2 The carton board case

Carton board handles small order quantities compared to the other segments investigated. This means that the number of orders is quite high. As in newsprint a lot of call-off orders are handled but the customers have sometimes hard to predict their actual need.

6.2.1 Information quality

As in the other investigated cases the information quality overall is perceived good. The information quality regarding forecasts from customers is considered good and most material is said to have very little time in stock. However, when looking at the inventory rate of consumer board, which carton board is part of, it is very low compared to the rest of the company. It has not been possible to fully confirm why this segment is slow moving but one can suspect that the turnover rate could improve with better demand information from customers; especially since many of the orders is call-off orders. When handling many small orders of which all are very customer specific it is important to produce it according to demand so that it does not get stuck in warehouse for too long. Also there were indications in the investigation that the demand information was not always very good but that this had to do with bad forecasts from the end customers. However, even if it is hard for the customers to predict their need it must be focus on improving the forecasts. It is always beneficial if the inventory turnover rate could increase.. Then one must keep in mind that the business characteristics of the segment also might affect the inventory turnover rate and that this cannot fully be improved with better information sharing. The demand is quite seasonal based why often material is produced and warehoused to be able to deliver during demand peaks. Still there is thought to be enough indications showing that proposition *P1* is rejected.

The information quality between CSC and mills seems to be good in the carton board case. One of the few perceived problem between the departments was when orders was over produced or delivered too late for the customer to have use for the material. In these cases the paper might be hard to sell since the orders are very customer specific and not very recurrent. However, this situation does not seem to occur commonly and in the cases when it occurs, it has not to do with bad information sharing. One problem which is derived from information sharing is the quota. The quota is divided segment wise and the staff at the CSC finds it difficult to divide it between the customers and give the customers reliable figures on how much capacity they will get. This might lead to some customers getting to much production capacity and the paper getting stored for too long while other might get their material later than needed. Also, as in all investigated cases the CSC feels that the information regarding delays at the mills could be more timely. However, in the carton board case the information is not of as bad quality that it should affect the stock levels due to uncertainty. Overall it still has been difficult to find a correlation between bad information sharing between CSC and mill and the inventory levels. P2 is therefore confirmed the carton board case.

Left-over inventory is a problem within carton board since there are many orders handled and all of them are very customer specific. Also the printing houses in many cases have shorter printing jobs and are not in the need of the material when their job is done. It is considered easy to identify the left-overs in the ERP-system, what is difficult is to know what to do with it. In other words it is not the information quality that needs to be improves. Proposition *P3* is based on this confirmed.

6.2.2 Enablers

The main enabler for information sharing is, like in the rest of the company, the ERP-system. The system provides most of the information except delay

information and forecast from customers. All information to provide visibility is in other words available but not all is shared through the ERP-system. Proposition *P4* is in this case also rejected. Then, as discussed, of course all information is still not fully fulfilling all quality demands and full visibility is therefore not obtained yet. Though the information quality drawbacks with the ERP-system is not as serious that it would not be able to provide visibility if used in the right way. Because of this, proposition *P5* is confirmed. It is still important to try to improve the information quality from the ERP-system. Also interviewees have indicated that the system might sometimes require quite a lot of workload to provide the information needed. This does not however affect any inventory levels and these kinds of problems are hard to avoid no matter what system is used.

Since the ERP-system is thought to provide the most information needed and of sufficient quality there is hard to see any use for any other software enabler. The interviewees feel that this would only increase their workload without creating any value. The main use investigated, to easy see where old stock occurs, is found to be very easy in the ERP-system and this further supports the confirmation of proposition *P6*. There has not been any other use found for a new software tool like for example MapPoint.

The only enabler missing according to the interviewees is more regular meeting in the operational work. The management has more frequently meetings between different departments in the sales organization. Probably more meetings also in an operational level would increase the understanding and exchange of information between departments. It would also decrease the spontaneous information sharing which is very time consuming.

6.2.3 Organisational aspects

Just like the rest of the company the information sharing between the departments are working quite well. There are not any obstacles to share information within the company. However, just like noticed in some other cases much of the information sharing is spontaneous and based on personal initiatives. This means that how extensive the information sharing is and what information is shared might vary depending on who is responsible for sharing the information. This can be noticed from the answers regarding how well the information sharing works, were it is said to be very different depending on what mill etc that is responsible. This could probably improve by more routines for information sharing and regular meetings were recurrent issues is discussed in presence of all concerned. This is also something requested by the interviewees. However, this kind of routines and meetings cannot take place without support from managers why proposition *P7* is rejected in this case.

As mentioned, also in this case the staffs are collaborating well with other departments within the company and the information needed is shared. Also the staff requests even more routines and meetings in order to enable even better and more efficient information sharing. Based on this, proposition *P8* is confirmed.

The information made available is used as much as possible in the daily work. In the carton board case slightly more routines for monitoring stock situation was noted compared to the rest of the investigated cases. This was considered to be standard procedure and very much effort was put in eliminating old stock and left-overs and also in keeping control of stock levels in general. The awareness among staff to why this was important seemed to be high. It is still

important to always try to improve and also within carton board improvements can be made. However, proposition *P9* is still confirmed.

6.3 The fine paper case

The fine paper segment is characterized by products with small differences like brands and packaging while the actual product is quite standardized. This means that there is little need for precise forecasts but focus lies rather on estimates of total production volume. Products also remain similar for a longer period of time than in other segments, meaning that the brand differences etc. are applied in the later stages of production. This allows for a more flexible production and is perhaps more suitable for handling demand fluctuations.

6.3.1 Information quality

The information seems to be of good quality within fine paper. Staff is pleased with the ERP-system and they believe that the information in the system fulfils the criteria in the analysis model. Information shared from customers however is not of good quality. Their forecasts are not accurate and this problem propagates to the sales plans which can only be used for rough planning. Fine paper locks sales plans for editing on the 15th each month which is a bit earlier than in other segments. The fine paper mill has a forecast system that suggests a production plan for the near future. This is system is purely based on historical sales data and works very well. This seems like a good solution considering that the products are standardized. The reason for this is that the sum of errors in each of the customer's forecasts is often evened out. There is no need for putting efforts in trying to be specific about which customers wants what. Such information sharing will in other words not be useful. This also means that proposition *P1* can be confirmed for the fine paper segment, i.e. inventory levels are not likely to decrease by increased

information quality regarding customer forecasts. The question is if it is necessary to use sales plans at all if the forecast system is working so well.

One thing that does not work quite as well is information sharing regarding delays in production. The sales coordinators are informed of planned production stops but there is often no information at all about unplanned stops or delays. Sometimes such information is received but then it is not timely. Since the staff needs to have knowledge about these delays in order to inform the customers, this is something that definitely needs to be improved. If customers do not receive deliveries in time and are not being informed, it could lead to exaggerated ordering and also bullwhip effects. In other words, proposition *P2* has to be false; if sales coordinators receives more timely information about delays, inventory levels could be decreased. This also seems like a relatively easy thing to get in order. For example, one mill has solved this by using a system that automatically informs about late orders.

Since the sales coordinator interviewed within fine paper almost only worked with direct deliveries and very few call-off orders she did not have much responsibility of monitoring stock situations. In the case were it was done the stock situation was updated continuously and the information quality regarding the stock situation was considered good. However, since it was a small share of the total orders handled it is hard to say anything about proposition *P3;* that left-over inventory can be reduced by improved information quality at the CSCs. It can however be confirmed that the problem exists within the segment. Another thing connected to this proposition is the knowledge about optimal truck loads. The staff seems to have access to this knowledge and this might contribute to less left-overs that occur due to sub-optimized loading.

6.3.2 Enablers

When comparing you notice that fine paper seems to have more enablers than the other two segments. First of all, they use Partnerweb which is connected to the ERP-system. This system shows figures such as inventory levels and order information. Whether this allows for increased visibility or not is uncertain because the data is collected from the ERP-system and only displayed in another way. Some people could perhaps perceive this as a more usable format than in the ERP-system and then the information quality would increase. The staff however feels that the ERP-system is providing information of sufficient quality to provide visibility and proposition *P5* is therefore confirmed in this case.

Secondly, the fine paper mill have recently begun using the TOPSY system which gives the contracted transporters access to the production system and allows them to book transports themselves. This kind of system will of course reduce the administrative work but will not increase the visibility at the company and could therefore not be seen as an enabler.

The system for indicating late orders however is definitely an enabler. It has been concluded that mills using this system are much better in informing about delays in production and delivery. The benefit of being able to notify customers early about delays is less insecurity in the supply chain which in the long run can lead to reduced inventory levels. Since information about delays cannot be found in the ERP-system, proposition *P4* has to be rejected. On the other hand, since this system definitely increases the visibility in the supply chain and is not used by all mills, proposition *P6* is rejected.

When asking about MapPoint, the staff did not see any use for it. This does probably not have to do with unwillingness to learn new applications since

fine paper uses several more applications than other segments. However, receiving too much information could make way for difficulties in focusing on the right things.

Other enablers that are used are phone and e-mail. These are often spontaneous conversations that take place when a need occurs. Much of the information exchanged is generated in the ordering activity. Of course there is information directly connected to the order that is placed, e.g. terms of delivery, price, specification and quantity, but since the customer need to phone in the order there is often also a discussion about the future. Customers might suggest an increased or decreased demand the coming month or perhaps a change of specifications. Most order information is forwarded to the mills through the ERP-system but whether the information obtained by discussing with the customer is forwarded is uncertain and no formal routines for this could be found. When the order has been send for production the customer receives an order verification to make sure that everything is correct. (Bremberg, 2010)

6.3.3 Organisational aspects

The organisational culture within fine paper seems to encourage innovative solutions. This manifests itself in systems like TOPSY and the delay notification system. These are however not used by every mill and it is hard to find a simple explanation for this. Of course the fine paper mill, which is in front with new systems, does not work with external warehouses which could make implementations easier. However, the staff is not very familiar with the responsibilities of others in the segment. This seems to be true even on a managerial level. If information could be exchanged between different actors within the segment on a regular basis, collaboration and sharing of ideas would be facilitated. The authors believe that other mills have much to learn

from the fine paper mill. This means that proposition *P7* is rejected, managerial support on collaboration could be increased.

The unclearness about other people's responsibilities could also lead to staff not knowing what information is relevant to share. However, no proof of unwillingness to share could be found, much due to the fact that all the actors within the company seem to feel like a single unit with the same overall goals. Therefore proposition *P8* is accepted. One thing to note is that the employee interviewed at CSC north did not express a clear need for improved information sharing but rather thinks that the daily work is handled fine alone most cases. The information shared today is used by staff why proposition *P9* also is accepted.

6.4 Cross-case analysis

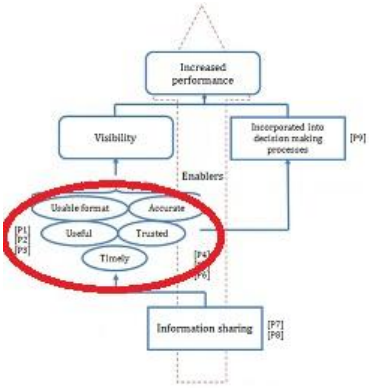
As seen the propositions have not been answered in the same way in all three cases. The authors were aware of the fact that this might happen and will in this section discuss important similarities and differences. An overview of whether the propositions was confirmed or rejected in each case is presented below. All propositions were expressed so that if rejected, improvements can be found.

Case/Proposition	Newsprint	Carton board	Fine paper
P1	√	X	√
P2	X	√	X
P3	√	√	n/a
P4	X	X	X
P5	√	√	√
P6	√	√	X
P7	X	X	X
P8	√	√	√
P9	√	√	√

Table 6.1: Summary of propositions.

All in all the authors believe that the mind-set and focus are alike in the three segments investigated. The means of achieving the goals although vary a bit, and rightfully so, because of the differences in products and markets. Collaboration and coordination of activities between segments obviously have its advantages but only to a certain limit. Below, the most critical activities will be discussed from a more holistic point of view and the propositions will also be discussed. The miniature of the analysis model indicates what parts of the model are interesting in each section.

6.4.1 Sales plans

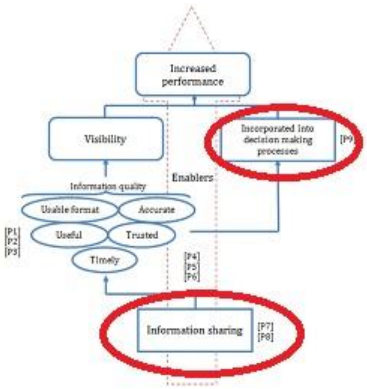


Sales plans are used in all three segments. The idea of sales plans is good but in order to for them to be useful it requires that everyone involved have the same focus and purpose of using them is. For this to happen, responsible managers must communicate the focus to the right people, i.e. primarily the CSCs. It seems like everyone interviewed in this investigation is clear about the general idea of the sales plans but there do not seem to be a common opinion on how they are used most effective. Perhaps a deeper understanding among CSC staff about the complete process from customer forecasts to quota and production planning could help improve the sales plans and the focus could be more aligned. The mills plans their production often a couple of months ahead, since the sales plans are not very accurate in this time span the use of them are less than it could be. The CSC focus very much on the coming month when updating sales plans but the mills do not find it very usable to have the sales plans accurate just one month ahead since the quota for this month is already put and most production planning done.

When looking at proposition *P1,* you can see that fine paper is the only segment which cannot benefit from improved information quality regarding customer forecasts. This has nothing to do with it being easier to estimate demand within this segment but rather the way of working with sales plans. In the fine paper case it is clear that the sales plans are used in a different way than in the other cases. Firstly, it is locked earlier than other segments (on the 15th instead of the 25th). This gives the mills more time for production planning. Secondly, it is used only as a complement to their own forecast system. This system has been very successful and no improvement potential

could be found. To work with sales plans in this way might not be possible for the other segments but it will definitely be worth investigating further. Since the forecasting system works with historical data it should not be a problem implementing it in other segments.

6.4.2 Routines and responsibilities



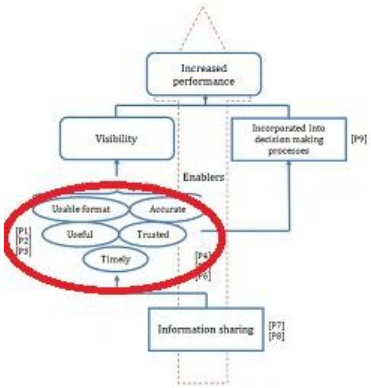
One thing that was noted during the investigation was that there was a lack of routines and unclear responsibilities in many places in the organisation. This affects the level of visibility in many ways that perhaps are not shown in the propositions. Proposition *P8* and *P9* are both true for all three cases. This means that the staff is both willing to share and use the available information. However, if there are no established routines, information sharing will only occur spontaneously and less benefits is achieved than if it would be routine based. This is a big problem that was found in all three cases. An example of unclear responsibilities can be found in the fine paper case where employees are sometimes unsure about who should monitor stock levels and look for left-over inventory. This seems like an unnecessary problem when, as mentioned before, there is a general willingness.

It is the responsibility of managers to resolve this issue by not only supporting information sharing and collaboration among employees, but also by establishing routines and clear responsibilities. Since *P7* was falsified in all three cases it seems like the company definitely is behind in this area. However, the segments can learn much from each other. Just as newsprint and carton board can be inspired by the way fine paper works with sales plans, carton board and fine paper can learn from newsprint about working with

monitoring left-overs. Newsprint has very clear routines about this and it is also the sales coordinators responsibility.

Another thing that was noted during the investigation was that some employees expressed the need for regular meetings involving co-workers, managers and staff from other departments. This is also something that the authors think can contribute to a more holistic view and aligned goals of the staff. Also cross-segment meetings would allow for exchanging experiences and learning from each other.

6.4.3 Delays



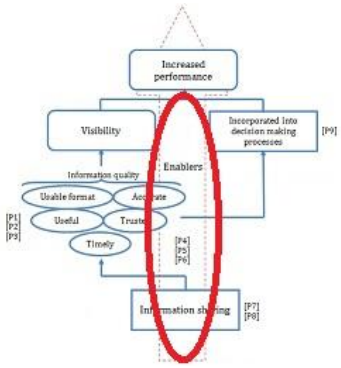
Production and transport delays were something that CSC staff mentioned as a problem within all three segments. This was also a big reason for propositions *P2* and *P3* to be falsified. The information about delays is not provided through the ERP-system and seems to be shared spontaneous by phone or e-mail. More often than not, the information is not timely and sometimes mills do not notify CSCs at all. The extent of the problem varies a lot and some mills are better than others. As mentioned earlier, the fine paper mill has a system for notifying CSCs if orders are late. This has proven to be successful and leads to increased visibility. Since the importance of notification is very dependent on what type of order, the employees need to have a good knowledge on how to handle and inform about delays. Also, in the cases needed routines need to be established for how to monitor the order situation in order to notify about delays in time.

However, when asking about the consequences of this problem, answers vary depending on the segment. Within newsprint, the general opinion is that the

problem might lead to insecurities in the supply chain. This can in turn lead to customer exaggerating their orders because they are afraid of not receiving the paper in time. No history of this could be found in the investigation but the authors definitely believe, based on theory, that the chances of this happening are likely. On the other hand, in the carton board segment staff does not think customers will build up extra stock because of delivery insecurities.

Since the consequences are hard to determine and the issue occurs in many places in the organisation, this problem needs to be dealt with. As with many other problems, the solution could perhaps be found within the company and in this case at the fine paper mill and its system for indicating late orders.

6.4.4 Software tools



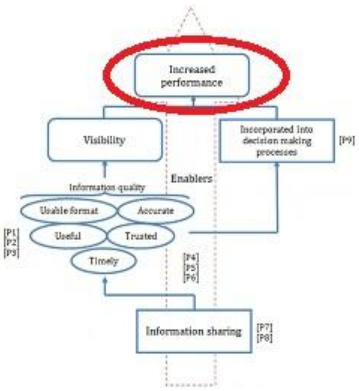
As seen in Table 6.1, proposition *P6* was confirmed in the cases of newsprint and carton board meaning a software tool cannot help increase visibility. However, when looking at the previous section about delays it raises the question whether this is correct or not. A software tool for sharing information about delays to make it more routine based could actually increase visibility but are not present in those two segments. Since the question that was put to the staff regarding this issue was rather open, asking if they could imagine any software that could help in the daily work, this might have been something that staff did not figure to be able to solve the problem regarding delays.

Regarding MapPoint however, the software was first described to the interviewee whereupon questions regarding its possible use was asked. None of the interviewees believed that MapPoint could help them in their daily work. The possibility of MapPoint being a good and visibility increasing tool to

use for management and analysts cannot be excluded though. The management was not a part of this investigation so conclusions cannot be drawn, but the author's opinion is that it will be worth investigating further. However, during the investigation MapPoint was reviewed by the authors. It was found that it can be a good application for overviews of warehouses and customers locations. Compared to the ERP-system which cannot use maps, MapPoint can for example be used to quickly see distances to get a hint of which delivery route is better, but since there are many other parameters to consider it will not be enough with just a map to be able to make a decision. The implementation of these parameters could perhaps be done but it will require programming. Another issue with MapPoint was that the conversion of data from the ERP-system did not work smoothly. The ERP-system does not have location data of the right format and level of detail to fully automate this process. This means that a lot of manual work have to be done and excludes the possibility of real-time updates which would be required to have timely information on the maps. The conclusion is that an application like to MapPoint could be a good idea, but the target group has to be identified first and their needs have to be specified. As this investigation has shown, operational staff does not have much use for maps but it could be a different situation for management etc.

6.4.5 Impact and cost-savings

There are many costs connected to inventory and it is hard to make estimation of how much there is to gain from increased information sharing. In the case of the company the inventory situation is very complex and affected by many factors among which information sharing is just one small part. How much of the inventory levels that would be



decreased by increased information sharing is therefore very hard to estimate. The reasons to why an order is produced earlier than it is needed to be delivered might be many and often production planning reasons affect it. However, some orders are held in stock because customers requested an earlier time of arrival than when the paper was actually needed. Situations like this might decrease with better information sharing.

The initial thought of this thesis was that there were too many warehouses and that it would be beneficial to decrease the number of these. However, only reducing the number of warehouses will most likely not decrease costs of inventory. The company does, as mentioned earlier, not own any warehouses but contracts external suppliers and only pays for the capacity used. This means that there is almost no cost of just having a contract with a warehouse, the cost occurs when paper actually is being stored. The focus should therefore be to reduce inventory and not trying to reduce the number of warehouses. Still, just by reducing the inventory the need for warehouses does not have to decrease. The warehouse is often needed since much of the goods are sent by rail from the mills but the customers in most cases do not have any rail access; the goods therefore need to be reloaded on trucks before the final delivery also there are too long lead times from some of the mills and warehouses is needed to decrease this. In these cases it is economically beneficial to have a warehouse as close as possible to the customer since the cost per ton*km is relatively higher the final transport. If it on the other hand would be possible to keep a common safety stock for customers using same specifications the inventory might decrease. However, since each warehouse serves as many customers as it does the number of warehouses would most likely not decrease since there are not enough similarities in the customer's specifications. The situation is illustrated in Figure 6.1, where it is shown that the total number of warehouses does not decrease but there is a redistribution

of which customers they supply. By this the inventory might be slightly reduced.

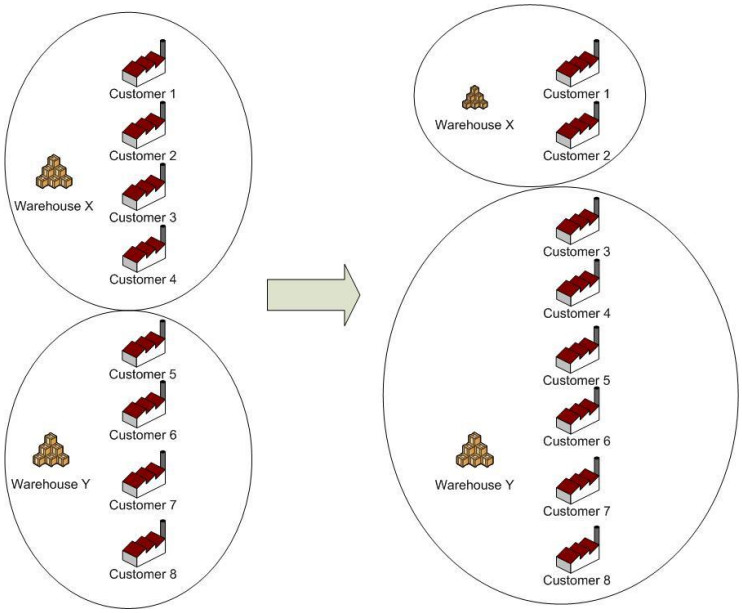


Figure 6.1: Reallocation of customers without decreasing number of warehouses

To be able to just keep a common safety stock and deliver more directly to the customers would require a more flexible supply chain with more effective information sharing. In the case of newsprint, the calculation used is that it costs 15€/ton extra just sending the paper via a warehouse instead of directly from the mill. This figure however, includes receiving, handling and delivery, i.e. the final delivery from the warehouse is included so the figure might be a bit misleading. However, using this to see what could be gained from using only direct trucks on the German market for example gives the results presented in Table 6.2.

Newsprint sales (German market, tons)	475 000[1]
Share of total via warehouse	50%[2]
Potential savings per ton	15 €[3]
Total savings potential	3 562 500 €

Table 6.2: Cost saving example Newsprint Germany

As seen there is a great potential but also one must remember that it is not possible to send all the paper directly to the customers. This has to do with capacity limits at the mills, lead times and service levels among others. However, coordinating safety stock through better information sharing and more precise direct deliveries would be able to save some costs.

To summarize; clear tendencies showing that information sharing is affecting the inventory has been found during the study. Orders, among other things, are sometimes produced too early because of bad information quality, customers might exaggerate their orders due to uncertainties and too much inventory is sometimes kept in stock. However, how big share of the total inventory will be affected by better information sharing can only be seen if implemented. The authors though, are convinced that positive effects come as a result.

[1] (Andersson, 2010)

[2] (Deppe, 2010)

[3] (Andersson, 2010)

7 Summary

In this chapter, conclusions will be drawn based on the findings and analysis in the previous chapters and give recommendations on how to improve in the problem areas. The chapter concludes with an evaluation of the study and recommendations on further research.

7.1 Recommendations

Below is a table showing the potential areas of improvements found in the study together with the authors recommended solutions. This section will go through the different areas and explain a bit more in detail the authors' thoughts.

Problem	Possible consequence	Solution
Different focus on the sales plan	Difficulties to set accurate and timely quota	Communicate the purpose of the sales plan to the right people and earlier locking dates
Untimely communication regarding delays	Insecurities among customers who might exaggerate their orders	Clear action plan, better knowledge and communication among staff
Hard to know what information to share and to whom	Important information not shared	More meetings involving multiple departments, continuous improvement work with information sharing
Unsufficient communication between segments	Innovative ideas and solutions not spread within the company	Benchmarking and shared process/activity mapping

Table 7.1: Identified problems, consequences and recommended solutions.

7.1.1 Different focus on the sales plan

As mentioned in the analysis chapter the authors have found that the time focus on the sales plan differs between the departments. This might lead to difficulties in the rough production planning where the quota is set. Also the quota might not be as timely as the CSCs wish. If the quota is not accurate or timely it might lead to bad distribution of production capacity and unnecessarily high inventory levels.

The authors believe that a more aligned view of what the purpose of the sales plan is and what it should be used for could help increasing the information quality in the sales plans. In the discussions of a more aligned view it might show that some business areas should have other dates for locking it than what is currently used. The study has showed that for example fine paper locks their sales plan earlier and this might also be a possible solution for other segments.

The authors have not been able to specify any figures of what is to be gained from this potential improvement. However, better distribution of production capacity to the different customers would most definitely have a positive impact on the inventory situation, meaning that paper is not piled up at locations where it is not needed.

7.1.2 Untimely communication regarding delays

The second identified problem concerning information sharing is the bad communication regarding delays. When a delay occurs, the information is either not shared at all or, if it is shared, is not timely enough. The consequences of this bad communication differ a bit from case to case. Although in all cases it seems to lead to insecurities among customers who tend to exaggerate their orders or require an earlier delivery time than actually needed. This might affect both left-overs if the orders are exaggerated and inventory levels.

The main solution to this problem is believed to be better routines and action plans so that the staff at every mill knows exactly when and who to inform at the CSC. Also better awareness of how the different departments work might affect the tendency to share information.

By improving this area it seems clear that the inventory levels and left over could be reduced. Exaggerated orders lead to higher inventory levels and if ordered more than needed there will be left overs.

7.1.3 Unclearness regarding information sharing

This problem; that it is hard for employees to know what information to share and to whom, is in a way connected to the previous one. The problem seems to be derived from the fact that employees from different departments do not have a very clear view of how others are working. This makes it hard to know what information might be beneficial for the other departments to get and also to some extent what information to take actions on. The information that is concerned is information like for example general production situation. This is non-regular information that is not handled each day and it is hard to see how it might be useful for other departments.

By more regular meetings between departments in the sales process the employees would get a better understanding of how information could be useful to others. Also it enables spontaneous information sharing but in a routine based manner. By discussions between colleagues continuous improvements on information sharing would also be easier since there would be an on-going dialog of what need to be improved. Probably it would be enough with monthly or even less regular meetings. Otherwise there is a risk of the costs exceeding benefits and also there is not enough information to exchange if the meetings are to recurrent.

This solution is probably one of the most difficult to see the direct connection to better inventory situation. One has to rely on theory and also see to other benefits like a more aligned process. In order for this to work it will also require better support from managers since the employees themselves cannot initiate meeting routines.

7.1.4 Unsufficient communication between segments

In the beginning of this study the authors got the impression that there were massive differences between the segments in the company. However, when investigating the three cases it was shown that the similarities were more than the differences. Also, the study indicated that there was not very much exchange of ideas and solutions between the segments at least not on the level where this study took place.

After investigated the three cases the authors believe to have found things at all three segments that the other two could benefit from. Better benchmarking between the segments could improve the performance of the sales process in all the segments. Also better process mapping which could help others understand the process would be beneficial. The author got the impression that the overall understanding of the process was not very deep. To summarize; it is important to look at the similarities and learn from each other instead of focusing on the differences.

Of course the impact of this solution is impossible to estimate. The connection to inventory levels is not very clear but still if all do what the other do best the inventory situation would most probably improve. For example newsprint seem to have good routines for left-over monitoring which might could be useful for other segments to use and thereby decrease left-overs. Within fine paper they seem to have a very good forecasting system as mentioned earlier. If this is showed to be usable within other segments it might improve the inventory situation.

7.2 Conclusions

In the initial stage of this thesis the impression was that the inventory situation was in need of great improvements and that the information available was used in an inefficient way. However, the study has shown that most information needed in the daily work is available to the employees through the ERP-system. In some cases the information quality in the ERP-system could improve. However, this is mostly information that is manually put into the system like quota and orders so it is not the system that needs to be improved but the information put into it. Also the inventory situation does not seem to be as bad as the authors first thought and a quite small part is affected by information sharing.

The most obvious improvement of information sharing is the routines for how to share information. Much information is shared and used spontaneous which make the timeliness of the information very different depending on what department is responsible. Also a more clear process mapping will help increase the understanding of the purpose of information sharing among employees and thereby improve its performance. It is also important to continuously work with improvement of the information sharing since new information gets available and other might get useless. One other thing that has been shown is that the different segments can benefit from learning from each other. However, it is important to keep in mind that there are differences and it is not always good to try to work in a certain way just because others do it.

As mentioned earlier, the impact of improved information sharing is very hard to estimate. Especially the connection between information sharing and the investigated problems inventory levels and left-overs has been difficult to find. The most obvious is the forecasts that need to be improved and the bullwhip

effects caused by insecurities among customers. It is also clear that the theory on the subject is very much based on and inspired by the retail industry which differs a lot from the company's situation in the paper business. The factors affecting the inventory in the case of the company are many and complex. Also, the company is operating an industry with very heavy fixed costs compared to the inventory costs. Therefore it is important to always keep the production running as long as the products get sold somehow. Also visibility and information sharing do not directly affect the inventory as theory sometimes claims. The authors still believe that information sharing is very important and especially when the process is as complicated as it is in the company, it is important that all information is available and it is clear how it should be used in a more efficient way. This is important not only for inventory levels but also to get better working processes which are more efficient. With a more efficient sales process it would be possible to decrease the administrative work and through this also save some costs.

7.3 Evaluation and further research

Most of the theory is based on the retail industry and are therefore not fully applicable in the case of the company. There are although similarities and cases when theory is applicable and of which some have been found in this study. It is also obvious that theory is very closely connected to process thinking. The main solution to the inventory problems does not seem to be found in information sharing. Probably information sharing affects it more indirect than shown in the study through improvement of the processes.

During this study, the authors have noticed that the business processes at the company need to be analysed from a broader perspective. As concluded above, information sharing can only affect the warehousing problems to some extent and therefore a wider scope can be useful to have.

This study is mainly focused on operational staff and their daily work. If more attention can be directed to management and analysts, perhaps other use of information sharing can be found. Also, the study is limited to warehousing problems but benefits that are of a more administrative art could also be noticed.

Due to the limited time frame of this study, only three segments could be investigated. A similar investigation, including several more segments, can therefore be interesting. To further strengthen the results, a more quantitative investigation can also be carried out. This approach can help providing a more detailed mapping of internal differences within the segments since it can include more employees.

All in all, it has been an interesting study and some quite interesting findings have been made. Also it has been very interesting to apply the theory of supply chain visibility in a somewhat new business field.

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Appendix

In this chapter the interview guide used during the case studies is presented.

Interview guide

This guide was used in all of our deep interviews. The questions were sent to each interviewee in advance along with a short description of the purpose and background of the thesis. All questions were not relevant to ask in every interview depending on the interviewee's position at the company. The questions were quite open and sometimes follow-up questions were asked. All interviews were transcribed and sent to the interviewee for approval. The transcriptions are not included but are filed at the university.

General questions

Describe your role and responsibilities at the company?

What are your daily tasks?

What people do you communicate with (customers, others departments etc.) and regarding what issues?

Perceived problems

Do you believe that the inventory levels could be reduced?

- By how much?
- Why are the levels too high?

Do you experience problems with "left-over" stock?

- Damaged or claimed goods?
- Odd units that gets stuck and forgotten?

Do you think that the number of warehouses could be reduced?

Order handling

Approximately how many specifications/products are there?

- How big share of the customer's specifications are the same?

How good are customers at dividing their orders according to call-offs?

- How detailed call-off forecasts are provided when customers place orders?

- Do you use that information when creating the orders in the ERP-system?
- If no, why not? What information may be missing?
- Do you ever batch several smaller orders into one bigger?

How recurrent are the orders from the customers?

- In terms of specification, quantities, way of transport etc.
- Is there any review of the consignee's call-off history?

Do you have information about optimal truck loads and containers etc.?

- How many reels per load?
- Do you take this into consideration when placing orders?

What is your sales plan based on?

- How accurate are the sales plans?
- What information could help improve the sales planes? In terms of accuracy and time span.
- How far in advance to you finish your sales plans?

How is communication handled with the mills?

- What information is communicated and why?
- Do you receive information about production stops and production forecasts from the mills?
- Do you receive information about transport or production delays?

Stock levels

Do you believe that keeping down stock levels is your responsibility?

Do you monitor the stock situation?

- How frequent?
- Which warehouse?
- What data – stock level, stock turnover, age of stock etc.?

Where do get your stock figures?

- ERP-system? E-mail? Phone?

- Do you find these figures reliable? Are there sometimes incorrect information?

How long is the paper in stock on average before the final delivery?

- Are there big variations in stock levels during a month?

How big share of orders is direct deliveries and how big share is warehoused in between?

How big share of orders is stored at a warehouse and how big share is stored at a mill?

Is the call-off/ordering pattern ever discussed with the buyers/consignees?

- Have you ever tried to set up fixed deliveries, for example per week?

Do you have any information regarding the buyers' call-off pattern?

How many warehouses do you use?

- What factors decide how many warehouses are used are their locations?
- Do you have a good overview of the alternatives regarding warehouses?

Do you find it easy to identify left-over stock?

- How can this process become easier? What information would be needed?

Customers relations

How many customers do you have?

- Numbers of buyers? Number of consignees?

What customer data do you have access to? Location, size, specifications etc.?

Is all this data stored in the ERP-system?

How is communication handled with customers?

What is included in the contracts with the customers?

- Transportation mode
- Warehousing costs
- Minimum stock levels

- Stock ownership
- Which warehouse used
- Ordering and call-of
- Delivery

Do you work with ordering forecasts from customers?

- Which customers? Important customers?
- How far in advance do you get forecasts?
- How accurate are the forecasts?
- Do you experience exaggerated forecasts from customers due to less capacity than demanded?

Do customers provide any other useful information?

Software

What information that is useful to you can be obtained from the ERP-system?

- Do you know how to get this information?
- Do you feel you that further training in the ERP-system could be helpful?
- Do you feel that information is provided in a user-friendly way?

Could it support your work with a more user friendly presentation of the information?

Are you using any other software except for the ERP-system?

- Which one and why?

Do you think that a tool for visualizing data on a map could be helpful in your work?

- If yes, what data do you want to see and why?

Are you familiar with the MapPoint application?

Other

Do you believe that you have sufficient information to be able to perform your tasks?

Is there information that could help improve your daily work that is missing today?