



***Proposal for Improvements
in Supply Chain Management
at FMC Kongsberg Subsea***

— With Focus on Customer-Supplier Relationships

Master thesis in
Industrial and Information Management

by

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Preamble

This master thesis project was provided by FMC Kongsberg Subsea (FKS) and Senior Quality Assurance Supply Chain Engineer Michael Campbell. Basis was FKS' wish to investigate their relationships with suppliers in general, and identify possible improvement areas in relation to supplier handling. Further, cause and effect relationships were to be established, enabling identification of possible actions to be included in an internal improvement project.

The foundation for addressing these tasks were provided primarily through the Supply Chain Management (Professor Bo Terje Kalsaas) and Methodology (Professor Arne Isaksen) courses at Agder University College. In addition, Strategically Economics Management (Professor Trond Bjørnenak) has been relevant.

The empirical investigation conducted to identify improvement areas, cause and effect relationships and possible solutions was performed in cooperation with HiBu student Silje Ristvedt and Lene Sundkvist. This included the establishment of an interview guide as well as performing interviews and brainstorming sessions with FKS employees and suppliers. I would like to thank Silje and Lene for their great attitude and collaboration.

Project supervisors have been Michael Campbell from FKS, and Professors Bo Terje Kalsaas and Arne Isaksen from Agder University College. Michael Campbell has been a great resource and fantastic support throughout the entire project. I am very grateful for all the goodwill he has shown and the laughs we have shared. I want to thank Bo Terje Kalsaas for his contribution especially to the theoretical foundation of this master thesis, and Arne Isaksen for his guidance particularly in relation to methodology and the empirical investigation.

Further, I would like to thank all the FKS employees and suppliers that have shown interest in this project and participated in interviews and brainstorming sessions. The empirical study had not been possible without the valuable contribution from experts. In this regard, I would especially like to thank the representatives from Bennex, Kristiansand Skruefabrikk og Mekaniske Verksted, Kitron Arendal and Multimaskin for attending our supplier conference, Simen Skiaker from Kongsberg Automotive for his contribution to the comparative analysis,

and John Bjarne Bye at FKS' Strategic Procurement department for his input on FKS' strategic approaches to suppliers.

Sylvia M. Løver, Kongsberg 06-05-29

Summary

The basis for this master thesis is the principles of Supply Chain Management (SCM) and theoretical approaches to customer-supplier relationships. SCM is a broad management concept addressing the dynamics of supply chains, seeking to manage these in the most optimal manner. Supply chains are value-adding chains of sub-suppliers, suppliers, manufacturers, distributors and end customers, where the success of each participant is to certain degrees dependent on the supply chain as a whole.

The management of supply chains concerns decisions on a strategic level regarding the degree of cooperation among the participants and the organization of transactions. Several different theoretical approaches apply in relation to customer-supplier relationships. The Principal-Agent theory seeks to determine the most efficient contracts when dealing with the agency problem; fear of opportunistic behavior and the existence of different risk preferences in the relationship between the principal (customer) and the agent (supplier). This is closely related to the division of power and dependency in such relationships. The Transaction Cost theory addresses costs related to market-oriented transactions between customers and suppliers; and seeks to guide managers in their effort to organize in an optimal manner; make or buy. Thus, the Transaction Cost theory perspective discusses an either market-based or hierarchic approach to customer-supplier relationships. The Network Based perspective introduces a network-oriented type of relationship, in between market-based and hierarchic, which is not included in the Transaction Cost theory perspective. Network-oriented relationships are characterized by trust and long-term commitment between independent actors, suggesting that firms that connect to their networks with embedded ties have greater chances of survival than firms that connect to their networks with arms-length ties. The Resource-Based theory perspective introduces another approach to the make-or-buy question; focusing on a

company's core competence, implying that corporate managers should look inward and consider what they do best as opposed to trying to do everything for their current customers.

Further, Porter's Five Forces model describes the rules of competition in traditional customer-supplier relationships (competitive relationships where both parts try to reduce the others position of power as there is a game of win or lose). The rules of competition are embodied in five competitive forces; the entry of new competitors, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers, and the rivalry among existing competitors. The contrast to traditional customer-supplier relationships is partnership-based relationships; when customers and suppliers enter a partnership where both parties play a win-win game. Together they try to increase the total competitiveness of the entire supply chain and thereby also increase the total profit margin. Commitment, trust and long-time aspects are key words in this type of relationship. Further, the parties should be mutually dependent, and the partnership approach should be a part of both parties' strategies

The management of supply chains is concerned with building the most optimal supply chains. Supply chain optimization can be described as the coordination of linked resources across all or parts of a supply chain to build the most efficient supply chains. Lack of leadership vision, poor customer relationship management and lack of trust and collaboration across the supply chain are some of the obstacles in seeking to achieve this.

Kraljic's portfolio approach provides strategic approaches to customer-supplier relationships by classifying suppliers based their products' significance for the customer, implying closer relationships the higher the product significance and lower product availability in the market. In relation to FKS, this concerns the question of how strategic approaches to suppliers and supplier handling are identified.

Thus, the research questions of this master thesis included the following aspects: (1) How does FKS organize the handling of suppliers?; (2) Where are the main weaknesses in FKS' supplier handling?; (3) Which methods are suitable to improve FKS' supplier handling?; and (4) Which actions could a SCM improvement project consist of for FKS?

The FKS Procurement Process describes how FKS is carrying out its processes for the planning of purchases, establishment of contracts, production, logistics, strategic

procurement, and supplier development. The FKS process principally consists of the steps of the *procurement life cycle*.

Regarding strategic approaches to supplier, FKS has not formally classified their suppliers by the principles of Kraljic's portfolio approach, but the criteria that have been identified for determining eventual establishments of frame and partnering agreements are closely related to Kraljic's classification method. In this sense, frame or partnering agreements are or will be established with suppliers of high significance for FKS (in relation to spend, capacity, degree of specialized products etc.) to secure compliance with future demand. Simplified procurement is established with suppliers of more standardized products.

Root Cause Analysis has been the method for performing the empirical investigation and analysis to determine the main weaknesses in FKS' supplier handling. This method includes (1) Problem identification and description, (2) Determination of possible causes, (3) Cause verification, and finally (4) Solution development. Problem identification and description concerned identifying and describing improvement areas in the relationship between FKS and their suppliers. This was done through interviews of FKS employees and selected suppliers based on the established interview guide. Further, brainstorming (also with FKS employees and selected suppliers) provided the identification and verification of possible root causes, as well as possible solutions.

Identified improvement areas in the relationships between FKS and their suppliers are primarily based on the need for increased training of FKS employees and suppliers, clarification of roles and responsibility, establishment and implementation of distinct strategies regarding supplier handling (including closer cooperation with strategic suppliers), and systematic approach to pro-active supplier development. In this regard, this master thesis may contribute to the development of strategies based on theoretical approaches to supply chain management and supply chain participants' behavior. This is related to the organization of the supply base (determining market- or network-oriented approaches), and how to protect relationships with suppliers through the establishment of contracts. Further, the solutions and actions that have been proposed (page 89) are aimed at directly addressing the current challenges in the relationships between FKS and their suppliers.

Table of Contents

1	Introduction	9
2	Key Concepts and Ideas of Supply Chain Management	11
2.1	Defining Key Concepts	11
2.1.1	Supply Chain	11
2.1.2	Procurement	13
2.1.3	Logistics	16
2.1.4	Supply Chain Management (SCM)	17
2.2	Understanding Supply Chain Participants' Behavior.....	20
2.2.1	The Principal-Agent Theory Perspective	21
2.2.2	The Transaction Cost Theory Perspective	22
2.2.3	The Network Based Theory Perspective.....	24
2.2.4	The Resource Based Theory Perspective	25
2.2.5	Theoretical Contributions to Customer-Supplier Relationships	26
2.3	Customer-Supplier Relationships.....	26
2.3.1	Vertical Integration	26
2.3.2	Subcontracting.....	27
2.3.3	Vertical Integration vs. Subcontracting.....	28
2.3.4	Power and Dependency	28
2.3.5	Relationship Levels	31
2.3.6	Traditional Customer-Supplier Relationship	32
2.3.7	Customers and Suppliers as Partners	34
2.3.8	Traditional vs. Partnership Relations	35
2.3.9	Other Aspects Affecting Supply Chain Relationships	36
3	Managing Supply Chain Relationships	38
3.1	Supply Chain Optimization.....	38
3.2	Supply Chain Obstacles and Possible Solutions	40
3.3	Behavior towards Suppliers	41
3.4	Developing Efficient Supply Chains.....	45
3.5	Issues to Be Addressed.....	47
4	About FMC Technologies and FMC Kongsberg Subsea.....	49
4.1	About FMC Technologies, Inc. (FMC TI).....	49
4.2	About FMC Kongsberg Subsea (FKS).....	51
4.3	Products.....	52
4.3.1	Template and Manifold	53
4.3.2	Drilling and Wellhead	53
4.3.3	X-mas Tree Systems.....	53
4.3.4	Workover System.....	54
4.3.5	Intervention System.....	54
4.4	Customers.....	54
4.5	Major Suppliers	54
5	Organization, Procurement and Communication with Suppliers.....	55
5.1	Organization with Suppliers.....	55
5.2	The Procurement Process	55
5.3	Strategic Approach to Suppliers.....	57
5.3.1	FKS – Supplier Agreements.....	58
6	Empirical Investigation and Analysis	59
6.1	Background - Documentation of theories	60

6.2	Background - Introduction to FKS.....	60
6.3	Method for Empirical Investigation - Root Cause Analysis	60
6.3.1	RCA as Choice for Empirical Investigation and Analysis.....	60
6.3.2	Research Type	61
6.3.3	Interview Guide.....	61
6.3.4	Interviews/Data Collection.....	61
6.3.5	Expected Results	62
6.3.6	Validity and Reliability	62
6.3.7	Problem Identification and Description	64
6.3.8	Ranking, Prioritizing and Summarizing.....	64
6.3.9	Determination of Possible Causes.....	65
6.3.10	Cause Verification (Data Collection).....	66
6.3.11	Solution Development.....	66
6.3.12	Comparative Analysis	66
7	Results of RCA.....	67
7.1	Problem Identification and Description	67
7.1.1	Identified Improvement Areas	67
7.2	Determination of Possible Causes/Cause Verification/Solution Development	73
7.2.1	Improvement Area “Documentation”	74
7.2.2	Improvement Area “Communication”	76
7.2.3	Improvement Area “Forecast”	79
7.2.4	Improvement Area “Sub-suppliers”	81
8	Theoretical Contributions to Improved Supply Chain Management at FKS.....	83
9	Comparative Analysis with Kongsberg Automotive	84
10	Way Forward.....	87
11	Conclusion.....	89
12	References	92
13	Attachment List.....	94

List of Figures

Figure 2-1 A principal supply chain..... 11
Figure 2-2 Adopted from "A frame of reference for Supply Chain Management" 21
Figure 2-3 Based on Michael Porter's Five Forces Model 33
Figure 3-1 Based on Kraljic's portfolio approach..... 43
Figure 4-1 Featured Technologies..... 50
Figure 4-2 FMC bases and entities woldwide 50
Figure 4-3 FMC subsea production systems 52
Figure 4-4 FMC Template (left) and Manifold (right) systems 53
Figure 6-1 Example of Priority Grid 65
Figure 6-2 Cause and Effect (Fishbone) diagram principle 66

List of Tables

Table 2-1 Procurement types..... 15
Table 7-1 The 22 main improvement areas..... 68
Table 7-2 Top 10 improvement areas ranked and summarized 69
Table 7-3 Top 2 possible root causes and solutions for improvement area "Documentation" 75
Table 7-4 Top 2 possible root causes and solutions for improvement area "Communication"77
Table 7-5 Top 3 possible root causes and solutions for improvement area "Forecast" 79
Table 7-6 Top 3 possible root causes and solutions for improvement area "Sub-suppliers"... 81
Table 10-1 Action list for an internal improvement project at FKS 89

1 Introduction

Companies are today in general exposed to highly demanding markets. These markets are often characterized as being turbulent and dynamic, meaning that customer requirements may change both quickly and often in unpredictable ways. In addition, the markets are often seen to be strongly segmented and globally oriented. Different customers demand different products and services, which leads to companies having to deal with segmented markets, multiple product varieties and customization. The presence of global competition forces companies to meet these requirements faster, better and cheaper.

“Competition is at the core of the success or failure of firms... Competitive strategy is the search for a favorable competitive position in an industry, the fundamental arena in which competition occurs. Competitive strategy aims to establish a profitable and sustainable position against the forces that determine industry competition.” (Porter 1998)

Companies are usually parts of supply chains that connect the process steps such as acquiring raw materials, manufacturing, assembly and delivery to end customer. Whether a company succeeds in being competitive and creating good results does not only depend on its internal performance, but also on the performance of its collaborating partners (Mattson 2002). Being able to create business relationships with customers, suppliers and other strategic partners is seen to be based on trust, and long time commitment then becomes a crucial competitive parameter (Mattson 2002). Increased vertical integration¹ requires increased coordination of resources and activities, which in turn results in greater complexity in management and control.

In the current competitive industries supply chains are thus becoming more important, and competition is seen to occur between supply chains rather than between companies. Supply Chain Management (SCM) is a management concept with the purpose of managing the different aspects of supply chains. Efficient SCM is regarded as one key to success in an

¹ Vertical integration refers to the involvement of a company in more than one of the steps from production of basic raw materials to the manufacture and distribution of a finished product. One example of vertically integrated companies is in the oil industry. Oil companies such as ExxonMobil, Royal Dutch Shell, or BP often adopt a vertically integrated structure. This means that they are active all the way along the supply chain from locating crude oil deposits, drilling and extracting crude, transporting it around the world, refining it into petrochemicals such as gasoline, to distributing the fuel to company-owned retail stations, where it is sold to consumers. (Wikipedia, 2006)

international and competitive market situation (Mattson 2002). SCM weaknesses are often results of issues created internally in companies, such as lack of consistent SCM strategies and poor communication (Kanter 1994). Such problems are subsequently seen to negatively affect relationships between companies, prevent efficient project work and reduce profits.

Basis for this master thesis project was FMC Kongsberg Subsea's (FKS) wish to strengthen its market position through reduced costs and more reliable deliveries. FKS had experienced different challenges in the relationships with their suppliers, but these challenges had not been investigated deeply or documented properly. Thus, the objective of this master thesis (described and provided through the project title and description) was to investigate these challenges and suggest improvements in FKS' Supply Chain Management with regards to supplier handling. The following targets were identified; (1) Determine the main weaknesses of FKS' SCM (in particular supplier handling); and (2) Propose solutions and a path forward.

In the next chapter relevant theories in relation to SCM will be reviewed. These theories provide basis for discussing the results of the empirical investigation, the latter performed through interviews (of internal employees and selected suppliers) and a following Root Cause Analysis (RCA) of major weaknesses/improvement areas.

RCA as method includes (1) Problem identification and description, (2) Determination of possible causes, (3) Cause verification, and finally (4) Solution development. The problem in question was identified by FKS, experiencing challenges in their relationships with suppliers. Qualitative data was collected through interviews, to enable a thorough description of the current challenges. Possible causes to the relevant problems were identified and verified, and possible solutions were suggested, through further discussions with FKS employees and suppliers. Finally, results have been discussed in relation to relevant theories.

This master thesis report begins with providing definitions of key concepts, and theoretical approaches to customer-supplier relationships and supply chain management. Further, research questions based on the theoretical foundation are stated and answered based on the performed empirical investigation and analysis. Conclusively, actions to improve the relationship between FKS and their supplier are suggested.

2 Key Concepts and Ideas of Supply Chain Management

The objective of the theoretical part of this master thesis is to provide the foundation for analyzing customer-supplier relationships with regards to supplier handling in FKS. Relevant key concepts will be defined on a general level and supply chain relationships will be discussed. The latter includes both the challenges faced when managing these relationships as well as possible ways of dealing with them.

2.1 Defining Key Concepts

“Before jumping into a new technology or business platform, it's important to first understand what Supply Chain Management is.” (Roop 2005)²

Supply chains and Supply Chain Management have become more and more popular topics for company managers, authors of books, magazine articles, etc. Providing a definition of key concepts is important as basis for understanding the dynamics in supply chains.

2.1.1 Supply Chain

A *supplier* is defined as an entity who supplies goods or services; either customer tailored products on order or standardized goods. (BridgefieldGroup 2006)¹⁶

In principal a *supply chain* can look like Figure 2-1:

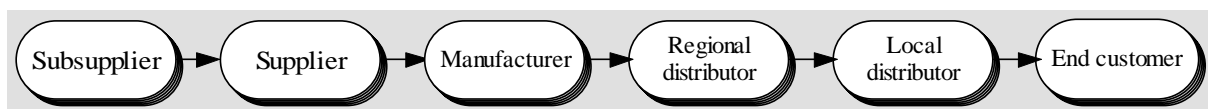


Figure 2-1 A principal supply chain

Based on (Mattson 2002)³

Basis for this master thesis is the understanding of a supply chain as a global network of facilities and distribution options that performs the functions of procurement of materials; transformation of these material into intermediate and finished products; and distribution of

² Steve Roop is Director of Marketing at PeopleSoft, Pleasanton, CA. PeopleSoft develops enterprise application software used for customer relationship management, human resource management etc. (www.peoplesoft.com)

³ Stig Arne Mattson is Professor in Supply Chain Management at Växjö University, Sweden. He has worked as a consultant on logistics, IT and business development and is member of the board of directors in the European Logistics Association in Brussels. Mattson, S.-A. (2002). *Logistik i försörjningskedjor*. Lund, Studentlitteratur.

these finished products to customers. This is done through a value-added chain, focusing on reduced costs and improved quality (Handfield and Nichols 1990).

An internet search on Google for the definition of *supply chain* provides a list of different explanations. It is worth noting that several of these definitions originate from consultants and/or consulting firms with products/services they wish to sell. However, the objective of presenting these definitions is to illustrate that different interpretation of the concept, and the extent of it, is potential grounds for misunderstandings. Thus, as basis for this master thesis it has been important to provide a distinct definition of a *supply chain* (presented above).

The following is a selection of the general to the slightly more detailed definitions provided on the World Wide Web:

“A chain or progression beginning with *raw material* and ending with the *sale of the finished product* or service.” (TECC 2006)⁴

“The supply chain represents the *flow of materials, information, and finances* as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer.”(Niven 2006)⁵

“The sequence of steps, often done *in different firms and/or locations*, needed to produce a final good from primary factors, starting with processing of raw materials, continuing with production of perhaps a series of intermediate inputs, and ending with final assembly and distribution.”(Deardorff 2005)⁶

“All of the elements in the process that enables the delivery of a product to a customer. The chain begins with the customer order acquisition/*procurement* process, links through *logistics*

⁴ Tasmanian Electronic Commerce Centre (TECC) is a developer of e-business services and solutions focusing on rural, regional and remote communities in Australia.

⁵ Paul R. Niven is an author, management consultant ([The Senalosa Group](#)), and noted speaker on the subjects of Performance Management and the Balanced Scorecard.

⁶ Alan V. Deardorff is Professor of Economics and Public Policy at the University of Michigan.

and manufacturing and ends with the suppliers and the acquisition of materials.” (CoreSim 2005)⁷

It might seem as superfluous listing these principally similar definitions. But each provides a different set of key words to describe the contents of a supply chain. The first definition states that the chain includes all process steps from raw material to sale of the finished product. The second emphasizes that these steps include the flow of not only materials/products, but also information and finances. The *product* flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. The *information* flow involves transmitting orders and updating the status of delivery. The *financial* flow consists of credit terms, payment schedules, and consignment and title ownership arrangements.

Thus, supply chains are end-user driven entities of flow of activities between all the members of this entity. A number of independent organizations or firms need to be linked in order to build up a supply chain (Halldorson, Kotzab et al. 2004).

As described by Deardorff (2005), different process steps are often executed in different firms and/or locations, making *logistics* (obtaining, producing, and distributing materials and products) an important part of the supply chain. CoreSim’s definition introduces the *procurement* function as a vital part of a supply chain, as basis for the relationship and communication between the different participants.

2.1.2 Procurement

Procurement is an important part of the interface between customer and supplier. It is important to note that *procurement* is a substantially broader concept than *purchasing*. The classic definition of purchasing is “to buy materials of the right quality, in the right quantity from the right source delivered to the right place at the right time at the right price” (Lysons and Farrington 2006). Further, Lysons and Farrington define procurement as “the process of obtaining goods or services in any way”.

⁷ CoreSim, headquartered in Ottawa, Canada, provides design analysis services to internal design teams within Original Equipment Manufacturers, Engineering Manufacturing Suppliers and Silicon Vendors.

ICG Commerce⁸ Europe has the following definition of procurement; “The entire process or function associated with the buying of goods and services to support business operations. Key steps of procurement includes: planning or needs analysis, strategic sourcing, purchasing, order management and ongoing cost and supplier performance management” (ICGCommerce 2006).

This emphasizes the main difference between purchasing and procurement. Purchasing is the transactional placement and processing of a purchase order. Procurement includes a formal sourcing process that begins with the placement of a requisition, which upon approval, becomes a purchase order and is sent to a supplier. Upon fulfillment, the buyer is invoiced and the supplier is paid. Some companies are also seen to include returns as a part of the procurement function. Returns mean creating a network for receiving defective products and supporting customers.

The Japanese just-in-time production philosophy⁹ is also reflected in definitions of *procurement*. Wikipedia¹⁰ (2006) defines procurement as “the acquisition of goods or services at the best possible Total Cost of Ownership (TCO), in the right quantity, at the right time, in the right place for the direct benefit or use of the governments, corporations, or individuals generally via, but not limited to a contract.”

On a more detailed level, procurement types (as shown in Table 2-1) are divided into *direct*, production-related, and *indirect*, non-production-related, procurement. Direct procurement is often characterized by large quantities and high frequency, but this depends on type of product; mass-produced or customized. Indirect procurement usually concerns low quantities at both relatively high and low frequencies. In supply chain management the focus is on direct procurement, directly affecting the production process of manufacturing firms (raw materials,

⁸ ICG Commerce is a procurement services provider committed to reducing procurement costs for their customers.

⁹ The basic elements of just-in-time (JIT) were developed by Toyota in the 1950's, and became known as the Toyota Production System (TPS). JIT was well-established in many Japanese factories by the early 1970's. JIT began to be adopted in the U.S. in the 1980's (General Electric was an early adopter), and the JIT concepts are now widely accepted and used (Raymond A. Jacobs, Professor of Business Administration, Ashland University, Ashland, Ohio). JIT is a management philosophy that strives to eliminate sources of manufacturing waste and cost by producing the right part in the right place at the right time. (VentureLine) (VentureLine provide on-demand MBA level analyses of public and private companies from financial performance, valuation and futures perspectives.)

¹⁰ Wikipedia is a reference website on the Internet and a registered trademark of the non-profit [Wikimedia Foundation](https://www.wikimedia.org/)

components and parts). On the other, hand indirect procurement concerns the resources a company acquires to enable its operations (office supplies, equipment, consulting services etc.).

Direct procurement and indirect procurement				
		TYPES		
		Direct Procurement	Indirect Procurement	
		Raw Material and Production Goods	Maintenance, Repair and Operating (MRO) Supplies	Capital Good and Services
F E A T U R E S	Quantity	Large	Low	Low
	Frequency	High	Relatively high	Low
	Value	Industry specific	Low	High
	Nature	Operational	Clerical	Strategic
	Examples	Crude oil in petroleum industry	Lubricants, spare parts	Machinery, computers

Table 2-1 Procurement types

Source: (Wikipedia 2006)

The *procurement life cycle* usually consists of seven steps; starting with information gathering (1). When a relationship is not yet established, searching for suppliers who can satisfy the requirements is necessary. After identifying suitable suppliers contact (2) must be made, this either as direct contact or through the requests for information and proposals. A background review (3) is often conducted, consulting references for product/service quality, requirements for follow-up services etc. As a supplier is qualified and chosen for a project, negotiations (4) are undertaken, and price, availability and customization possibilities are established. Delivery schedules are negotiated, and a contract to acquire the product or service is completed. During the fulfillment phase (5) supplier preparation, shipment, delivery, and payment for the product or service are completed, based on contract terms. Installation and training must also be included. The following step includes consumption, maintenance and disposal as well as evaluating the product or service (6). As the contract expires or the product or service is to be re-ordered (7) the company (based on the experience with the supplier and its products) determines whether to continue using the same supplier or consider other suppliers. (Wikipedia 2006)

As well as having established functional procurement processes, other aspects of the procurement function are also relevant. An article published in “Supply Chain Management Review” issued by Reed Business¹¹ provides a list of aspects that determine whether the supply organization is alive and well or a significant drag on corporate competitiveness. The article is excerpted with permission from the new book “Straight to the Bottom Line - An Executive's Roadmap to World Class Supply Management”. The authors (Rudzki, Smock et al. 2005) state that if a company still thinks of the supply process as purchasing they are living in the 1960s.

Having a good procurement team with a proper leader is vital in ensuring the success of any supply chain strategy. Understanding the overall business objectives and the fundamentals of supply chain management is crucial. In addition, the working relationship between purchasing professionals and those in other disciplines is highly relevant. Traditionally the role of most purchasing organizations/departments supporting manufacturing has been negotiating, developing contracts and placing orders for parts and materials. As procurement and manufacturing were significantly separated the supply base proliferated and became more difficult to handle. Another important aspect is that procurement focused too much on expediting part deliveries and coordinating the short-term resolution of quality issues. The authors of the article claim that in the 21st century corporation, procurement must play more a strategic (developing supply chain strategies as well as developing both new and existing supply chains) and less tactical (material requirement planning, generating purchase orders, receiving materials etc.) role. The latter recognizing the supply base as the most powerful allies. (Rudzki, Smock et al. 2005)

2.1.3 Logistics

The world of strategic management contains many different concepts. Moving from purchasing and procurement towards *supply chain management*, it is considered beneficial to include the definition of *logistics*.

The logistics concept includes the procurement function, but is not as wide a concept as SCM; “Logistics is the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the

¹¹ Reed Business provides a range of communication and information channels - magazines, exhibitions, directories, online media, and marketing services - across five continents.

organization and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfillment of orders” (Christopher¹² 2005, p. 4). In a historical perspective a company’s competitive force has to a far extent been based on the functionality and the technical quality of the product they manufacture. Increased competition in a global perspective has changed this, and functionality and quality are more and more taken for granted. Today, companies must be able to provide service to stay competitive. An important part of this service is directly concerned with logistic-related performance. This includes among others delivery precision and quality.

Thus, purchasing, procurement, logistics, and supply chain management (introduced below) are all concepts used to describe and manage aspects of relationships between customers and suppliers; purchasing as a part of procurement, procurement as a part of logistics, and logistics as a part of supply chain management. This emphasizes the width of SCM both as a concept, and as a challenge to strategic management.

2.1.4 Supply Chain Management (SCM)

Supply Chain Management (SCM) was first introduced by two consultants; Allen and Hamilton (Oliver and Webber 1982). SCM is a very broad management concept seeking to help a business get an overview of and manage cooperation in the supply chain.

As organizations transform from hierarchies towards markets, and engage in collaborating networks, the management of supply chains refers to a sort of inter-organizational relationship management, with the goal of an overall improvement of the profitability of the involved activities and/or institutions (Halldorson, Kotzab et al. 2004). Both upstream (supplier) and downstream (customer) aspects are important in seeking to deliver superior customer value at less cost to the supply chain as a whole. Efficient SCM can provide a major source of competitive advantage by attaining and keeping a position that gives superiority over competitors in terms of customer preference. (Christopher 2005)

Efficient management of processes as source of competitive advantage is also supported by the principles of Michael Porter’s value chain (Porter 1985). The value chain activities are

¹² Martin Christopher is Professor of Marketing and Logistics at Cranfield School of Management, UK, where he directs the Centre for Logistics and Supply Chain Management. He has published widely and is recognized as a leading authority on how supply chains can be managed to provide sustainable advantage. He is also co-editor of the *International Journal of Logistics Management*. (Pearson Education Limited)

divided into primary activities (inbound logistics, operation, outbound logistics, marketing and sales, and service) and support activities (infrastructure, human resource management, technology development and procurement). Thus, in Porter's frame of reference competitive advantage is a result of discrete activities performed in designing, producing, marketing, delivering and supporting a product. These discrete activities work as basis for differentiation leading to cost and/or value advantage. The value chain thinking seeks to help the company to see existing and potential sources of differentiation and thereby focus on strategically relevant activities (Christopher 2005). However, there is a distinct difference between Porter's value chain management and the principles of supply chain management. Porter focuses on the internal processes in a company as source of competitive advantage. SCM on the other hand introduces a more holistic view including the companies in the entire supply chain, arguing that competitive advantage is earned through efficient management of the supply chain as a whole.

Efficiency is a word commonly used when discussing the aims of supply chain relationships. It is often used as a concept to describe a company's return in relation to a certain resource input. Efficiency affecting profitability is divided into internal and external efficiency. Internal efficiency concerns internal processes and routines and external efficiency is related to the company's accommodation with the world outside.

Internal efficiency is used to describe how well business processes and material management contribute to value adding activities. Improving internal efficiency often concerns eliminating waste and other non-value adding activities (lean manufacturing¹³). Variables affecting internal efficiency include the utilization of resources, inventory sizes, time of flow through production as well as transportation costs. Internal efficiency first and foremost affects costs and working capital¹⁴.

External efficiency can be described as the market's evaluations of company performance regarding delivery in relation to expected delivery. Time and ability of delivery, flexibility etc. are variables affecting external efficiency. Hence, external efficiency is to a far extent

¹³ Lean manufacturing is a production philosophy aiming to systematically eliminate waste and solve problems through direct observation of activities, interconnections and flows (Wikipedia).

¹⁴ Working capital equals account receivables plus inventory minus account payables (Frode Løver 2006). (Frode Løver is Master of Economics and Business Administration and Executive Master of Business Administration from Norwegian School of Economics and Business Administration, Bergen, Norway).

based on efficient supply chain management (Mattson 2002). According to Mattson (2002) being successful requires both internal and external efficiency.

The following definition emphasizes primary goals of SCM;

“Supply Chain Management is the management of the entire value-added chain, from the supplier to manufacturer right through to the retailer and the final customer. SCM has three *primary goals*: Reduce inventory, increase the transaction speed by exchanging data in real-time, and increase sales by implementing customer requirements more efficiently.”(POET 2006)¹⁵

Further, communication throughout the supply chain is crucial for efficient SCM;

“SCM is the coordinated set of techniques to plan and execute all steps in the global network used to acquire raw materials from vendors, transform them into finished goods, and deliver both goods and services to customers. It includes *chain-wide information sharing, planning, resource synchronization and global performance measurements*.”(BridgefieldGroup 2006)¹⁶

Other important objectives of SCM are stated in the following definition;

“The design, planning, execution, control, and monitoring of supply chain activities with the objective of *creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally*.” (Quarterhouse 2006)¹⁷

Supply Chain Management is as mentioned before a broad management concept. It includes managing the supply chain as a whole by coordinating activities and resources to improve efficiency as well as gain and sustain competitive advantage in highly demanding markets. This emphasizes the basic idea of SCM; looking at processes across company borders to increase value creation in the entire supply chain. The outsourcing of activities and division of production steps among several companies are aspects of modern industries that make SCM more important and more demanding.

¹⁵ POET AG is a global provider of catalogue platforms for B2B (Business to business) e-Commerce and Supplier Relationship Management.

¹⁶ The Bridgefield Group has over 20 years of experience in planning, operations, quality, logistics, finance, IT, project management, consulting and with software vendors.

¹⁷ Quarterhouse Software is a solutions provider for business needs and data assimilation, reporting and analysis.

In principal SCM means organizing and managing the following five phases; (1) planning (forecasting demands, managing the resources and monitoring the supply chain); (2) sourcing (choosing suppliers, procuring goods, monitoring and improving supply chain relationships); (3) manufacturing (scheduling activities and measuring quality output and productivity a.o.); (4) delivery (coordinating receipt of orders, developing warehouses, getting products to customers and setting up an invoicing system); and (5) returns (creating a network for receiving defective products and supporting customers).

To summarize, Supply Chain Management is a coordinated set of techniques to plan, execute and improve all steps in supply chain. It includes chain-wide information sharing, planning, resource synchronization and global performance measurements (e-Tools and e-Business¹⁸). Integrated global Supply Chain Management is a strategy that recognizes the significant cost and service improvements to be gained by viewing the supply chain as a whole.

2.2 Understanding Supply Chain Participants' Behavior

According to the authors of “Designing and Managing Supply Chains: Theoretical Foundation and Application” (Halldorson, Kotzab et al. 2004) one needs to apply several theoretical approaches in combination in order to understand and explain management practices in supply chains. Understanding the behavior of supply chain participants and the process of establishing rules and contracts between them is crucial when seeking to optimize supply chain relationships. Halldorson et al. (2004) introduces three different perspectives, which can contribute to the explanation of the existence and management of supply chains: (1) An economic perspective represented by the Transaction Cost Economics and the Principal-Agent (P-A) Theory; (2) a socio-economic perspective illustrated by the Network Approach and (3) a strategic perspective represented by the Resource Based View of the firm. These theories are used to answer two questions; (1) How to structure a supply chain when it is perceived as a collaboration of institutions and (2) What is needed to manage a particular structure? (See Figure 2-2) (Halldorson, Kotzab et al. 2004).

¹⁸ E-tools and e-business refer to tools and processes that allow an organization to use Internet-based technologies and infrastructure, both internally and externally, to conduct day to day business operations such as sales, services, purchasing, commerce etc.

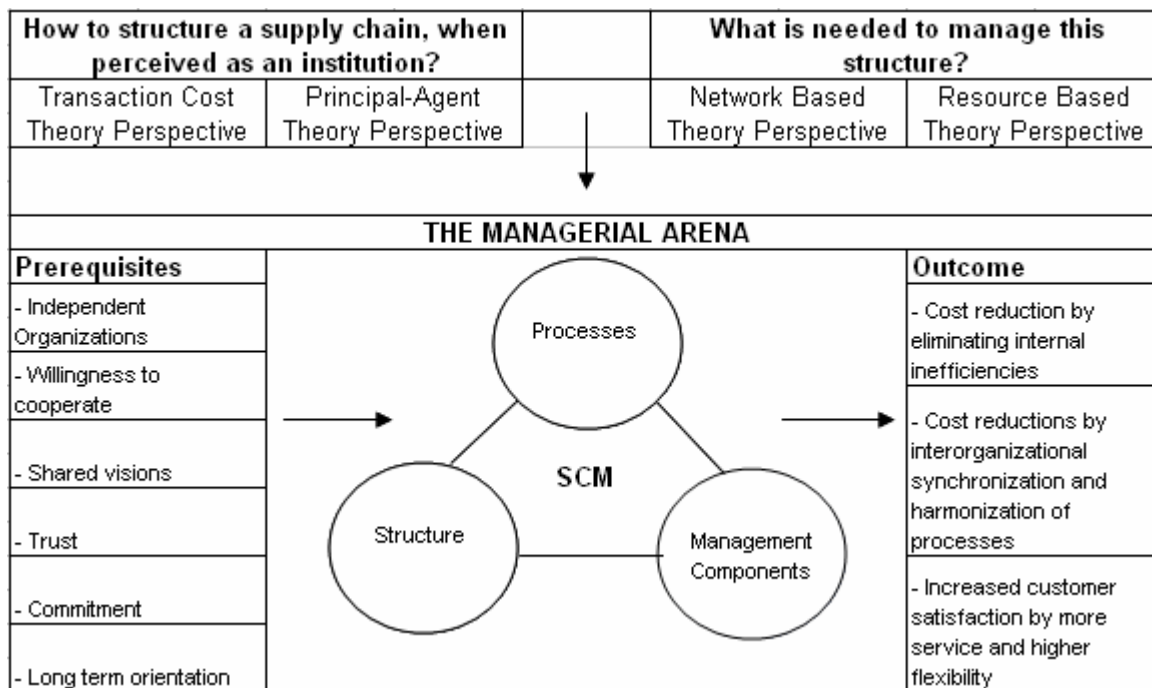


Figure 2-2 Adopted from "A frame of reference for Supply Chain Management"
Source: Proceedings of NOFOMA 2004, (Halldorson, Kotzab et al. 2004)

Halldorson et al. (2004) argues that the Principal-Agent and Transaction Cost theories can be used as basis for deciding how to structure a supply chain. As a structure is decided, the Network Based and Resource Based theories can contribute to managing this structure. Depending on a set of prerequisites, SCM; here the management of processes (customer oriented transformation capacities), structure (configuration of responsibilities) and management components (goal oriented directives), can contribute to reducing costs by elimination of inefficiencies and synchronization of processes, as well as increased customer satisfaction.

2.2.1 The Principal-Agent Theory Perspective

The Principal-Agent (P-A) theory is based on a relationship where one party (the principal) delegates work to the other (the agent), thus as a customer and supplier. The interests of the two parties can be seen to be potentially contradictory (assuming self-interested people and corporations), and conflict may arise if both parties' interests are not protected. The P-A theory seeks to solve the following problems in the relationship between the principal and the agent; (1) the desires and goals of the principal and the agent conflict and it is difficult or expensive for the principal to verify what the agent is doing, and (2) problems related to risk sharing that arises when the principal and agent may prefer different actions due to different risk preferences. The P-A theory seeks to determine the optimal or most efficient contract under varying levels of outcome uncertainty, risk aversion, information, and other variables.

When information is incomplete, principals must deal with the agency problem because of the fear of opportunistic behavior. Jensen and Meckling (Jensen and Meckling 1976) argue that agents may not adequately pursue the interests of principals for two reasons; moral hazard (lack of effort) and adverse selection (misrepresentation of ability). This refers to the possibility of the agent hiding information on questions related to capacity, competence and the effort the agent intends to invest to perform the identified task. The agent may thus merely pursue own interests, and undermine the interests of the principal. As information is asymmetric in this way, and it is expensive or difficult to monitor the agent's actions, the principal is exposed to undesirable uncertainty. Such aspects are also considered unfavorable in relation to SCM as transparent information is considered a success criterion (Kalsaas 2006).

For the principal there are two different approaches to the principal-agency problem; behavior-based (command and control) or outcome-based (giving incentives) contracts (Eisenhardt 1989). According to Eisenhardt the problem is most efficiently solved through the use of outcome-based contracts (aligning the goals of principal and agent, and as both are dependent on the same action risk is shifted to the agent) and information monitoring systems. This is based on the recognition of the agent being more likely to behave in the interest of the principal when the contract is outcome-based and the principal has information to verify the agent's behavior (Eisenhardt 1989).

The P-A theory can be seen in connection with Michael Porter's Five Forces model (Figure 2-3 presented in chapter 2.3.6), in relation to the vertical axis (called the "distribution" axis). As suppliers' power increases (as result of e.g. limited access to substitute products), it follows that the customer becomes more dependent on its supplier. In this case the supplier can chose to behave opportunistically (e.g. increase prices, reduce effort etc.). Following the P-A theory, such behavior can be counteracted through establishing efficient contracts and commitment from both parties.

2.2.2 The Transaction Cost Theory Perspective

The "cost of doing business" is central in relation to suppliers. Such costs include managing suppliers requiring extra inspection as well as redundant suppliers, finding and qualifying new suppliers, developing existing suppliers, transferring knowledge and the cost of daily management of delivery and quality. When buying from a supplier, such costs are never

included in the price of the product. Understanding true costs of suppliers require accurate costing systems such as those supplied through activity-based costing models. This way, such cost can be visualized and included in the selling price. Further, making these costs part of supplier analysis companies would be able to make decisions based on the overall lifetime costs of supplier relationships. This may also lead to more long-term strategic decisions. (Flinchbaugh 2001)

The Transaction Cost (TC) theory was established by Williamson (Williamson 1976) to explain the existence and organization of firms, and of economic institutions more generally. These are central issues in the field of strategic management. Within strategic management, transaction costs economics is the ground where economic thinking, business strategy, and organization theory meet. Transaction cost economics seek to explain why a contract has a particular structure and has particular features (Carroll and Teece 1999).

Transaction costs are defined as the costs of operating the economic system or the costs of consumption over and above the purchase price of a product or service (Geroski, Machin et al. 1997). Such costs arise principally when it is difficult to determine the value of the goods or service being produced or provided. They can arise either because the nature of the good or service is complex or because the exchange partner is untrustworthy. More specifically, the TC theory addresses costs related to market-oriented transactions between customers and suppliers; costs that vary, among others, with the complexity of deliveries. Further, the theory seeks to guide managers in their effort to organize in an optimal manner; make or buy. Williamson's logic provides a framework for outsourcing and vertical integration decisions. Basis is two behavioral assumptions; actors are boundedly rational and opportunistic.

Central to the TC theory is the difficulty of writing and enforcing contracts under uncertainty. A high level of uncertainty regarding future outcomes makes it extremely costly, if not impossible, to write and enforce a contract that specifies all possible future conditions. Designing a complete contract is further hampered by the bounded rationality of the actors involved, but with an incomplete contract the actors in the contract can not be trusted to remain true to their originally declared intent. Instead, they will act opportunistically and exploit any gaps in the contract. Conclusively, if a high level of uncertainty surrounds the transaction, the assets involved in the transaction are highly specific to the transaction, and the transaction occurs frequently, the firm may prefer internalizing a transaction over contracting

for the transaction. On the other hand, when transactions occur infrequently, involve highly certain outcomes, or do not involve specialized assets (standardized deliveries), the market will be a more efficient means of lowering transaction costs. (Vibert 2004)

2.2.3 The Network Based Theory Perspective

The Network Based (NB) theory perspective is built on the general notion that economic actions are influenced by the social context they are a part of, and that actions can be influenced by the position of actors in social networks (Gulati 1998). This can be seen in relation to the Transaction Cost (TC) theory perspective, which discusses an either market-based or hierarchic approach to customer-supplier relationships. The NB perspective introduces a network-oriented type of relationship, in between market-based and hierarchic, which is not included in the TC perspective. Market-based relations are often characterized by short-term transactions, while network-oriented relationships are characterized by trust and long-term commitment between independent actors. Thus, the NB perspective introduces aspects central to the development of certain customer-supplier relationships.

Basis for the theory is that networks arise when individuals and organizations interact. Uzzi (1996) suggests that firms that connect to their networks with embedded ties have greater chances of survival than firms that connect to their networks with arms-length ties. It is important to understand that the concentration of embedded ties is useful to a certain level. Too large concentration of such ties may lead to restricted supply of new ideas and knowledge from the outside of the usual network, and further lead to reduced ability to detect and react to external changes. This view is supported by Uzzi (1996), and further pointed out by Mattson (2002) in relation to aspects affecting supply chain relationships (chapter 2.3.9).

According to Burt (1992) the optimal network position is the one that provides the most access to information and resources, offers the least constraints, and takes the least effort to maintain. Strategic networks are seen to provide companies with access to information, resources, markets, and technologies; with advantages from learning, scale and scope economies. In addition, networks may allow companies to achieve strategic objectives such as sharing risk and outsourcing value chain stages and organizational functions (Gulati, Nohria et al. 2000).

Thus, membership in a network can improve the information that an organization has access to and it can enhance its control over its destiny. According to Gulati (1998) are actors who are strongly tied to each other likely to develop a shared understanding of the utility of a certain behavior because of their extensive social relations. On the other hand, networks have a potential dark side and may lock companies into unproductive relationships or prevent partnering with more viable actors (Gulati, Nohria et al. 2000).

2.2.4 The Resource Based Theory Perspective

Vibert (2004) asks the question of how major institutions of our time will prosper and survive in the coming years. He continues with saying that scholars, managers and consultants are coming to the conclusion that the future success potential of large institutions must come from within. Further, Vibert argues that large corporations can no longer protect themselves behind walls of government regulations or artificial industry entry barriers. Corporate managers are told to look inward and consider what they do best as opposed to trying to do everything for their current customers. Thus, focus on a company's core competence is central in the resource-based theory perspective. This implies an approach (based on core competence) to the make or buy-question different to the transaction cost perspective (based on cost of doing business).

A company can obtain a sustained competitive advantage using strategies that exploit rare, valuable, non-substitutable, and resources and capabilities that are difficult to imitate. The company must be concerned not only with profitability in the present, but also with its future position, and source of competitive advantage. The latter is a question of how to compete when their current strategies are copied or made obsolete (Hart 1995). Keeping in mind, strategy is a definition of a company not in terms of what needs it satisfies, but in terms of what it is capable of. Thus, the primary issue to be addressed is what a corporation can do better than its competitors (Barney 1996), to secure long-term corporate success. The possession of specific resources represents the basis of the capabilities. (Vibert 2004)

The resource-based theory perspective can, as the P-A theory, also be seen in connection with Michael Porter's Five Forces model (Figure 2-3), now in relation to the horizontal axis (called the "rivalry" axis). Aspects such as access to substitute products, existing number of competitors and barriers to entry are similar approaches within these theories as to analyze a company's competitive advantage.

2.2.5 Theoretical Contributions to Customer-Supplier Relationships

The different theories that have been introduced each apply to aspects of customer-supplier relationships, and seek to contribute to optimized organization of such relations. The Transaction Cost theory contributes to the determination of what to produce internally and what to have suppliers deliver. Having established connections with suppliers, the Principal-Agent theory contributes to the understanding of how companies should organize these relationships, either market- or network-oriented. The Network Based theory perspective emphasizes the need for developing long-term relations with suppliers in order to get access to important information and valuable resources. This can be seen in relation to Kraljic's portfolio approach (introduced in 3.3); organizing suppliers based on their significance for the company. This implies the need for mere market-oriented relationships with some suppliers, and closer network-based relationships with others. Further, the Resource Based theory emphasizes the importance of having a distinct strategy regarding core competence and handling of resources as this is considered crucial to long-term success. In a customer-supplier relationship perspective, where suppliers are defined as part of a company's resources, the handling of these is considered a competitive parameter. Thus, contributing to the development of suppliers may positively affect a company's competitive force, and secure future profitability.

2.3 Customer-Supplier Relationships

Suppliers may be connected to their customers in several ways; one way is by being vertically integrated, another is being a subcontractor. Each type of relationship implies different challenges depending on aspects such as e.g. power and dependency.

2.3.1 Vertical Integration

In microeconomics and strategic management, the term vertical integration describes a style of ownership and control. Control upstream (towards suppliers of raw material) is referred to as backward integration, while control of activities downstream (towards the buyer) is referred to as forward integration. Vertically integrated companies are united through a hierarchy and share a common owner. Usually each member of the hierarchy produces a different product, and the products combine to satisfy a common need. As production steps are divided by several different companies, the challenge in such relationships is often to coordinate the different activities in the most efficient manner.

Vertical integration is one method of avoiding the *hold-up problem*. The hold-up problem is a term used to describe a situation where two parties (such as a supplier and a customer) may be able to work most efficiently by cooperating, but refrain from doing so due to concerns that they may give the other party increased bargaining power, and thereby reduce their own profits.

The hold-up problem is closely related to the principal-agent problem discussed by the Principal-Agent (P-A) theory, as the P-A theory treats the difficulties that arise under conditions of asymmetric information and different risk preferences when a principal hires an agent. Such aspects are thus relevant in relation to *subcontracting*.

2.3.2 Subcontracting

A subcontractor is defined as one “who accepts work from another firm that has signed a contract with a customer” (Lazerson 1993) and more precisely “the manufacture of goods by one firm for another based on the latter’s specifications” (Lazerson 1993, p. 3). Subcontracting is divided into commercial and industrial subcontracting. Commercial subcontracting refers to that the role of the primary company (customer) is limited to marketing and distributing the subcontractor’s (supplier) finished product through its own sales network, and is itself not engaged in production. When the customer itself is engaged in production, e.g. the components and parts manufactured by the subcontractor are assembled and sold by the customer, this is referred to as industrial subcontracting. Thus, subcontracting is not identified by the products or services it provides, but the relationship to another firm and the market. For both types of subcontracting the relationship between the subcontractor and the end user must be mediated by one or more firms.

Aspects in relation to subcontracting are affected by the relationship between the customer and supplier. E.g. subcontractors of components can be in an especially strong position if they provide very specialized parts and there is limited access to substitute products (with reference to Porter’s Five Forces model, Figure 2-3), or they collaborate with the customer to jointly develop and produce a product. On the other hand, subcontractors marketing components that do not require a high level of technical skills, which can be easily substituted by similar products in the market, are in a relatively weaker position. In some places a subcontracting network develops around a large vertically integrated company that dominates it. In this situation, subcontractors may expand the number and diversity of their customers to

reduce their dependency on the large firm (Lazerson 1993). Aspects of power and dependency in customer-supplier relationships will be further discussed in 2.3.4.

2.3.3 Vertical Integration vs. Subcontracting

Coase (1937) argued that the decision to rely on the market occurs when the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange in the open market or the costs of organizing in another firm. Williamson (1975) asked why subcontracting is not more widespread, and answered it by saying that subcontracting creates excessive transaction costs; costs that occur where one of the parties is in a position to behave opportunistically. Williamson argues that transaction costs are greatest when highly specific assets are involved in exchanges because they create situation of bilateral dependency. Thus, the competitive function of the market fails when the number of qualified buyers and sellers is too small. According to Williamson the solution is not costly bargaining and negotiating, but substituting subcontracting arrangements with backward or forward integration. Reliance on mere subcontracting is justifiable if self-executing contracts can be completed as soon as payment is made, if the transactions are non-repetitive, if the products require minimal capital or skills, or if there are standardized and non-complex products. But these exceptions exclude most subcontracting agreements that involve specialized production for specific customers.

2.3.4 Power and Dependency

Supply chain participants strive to gain profits through interacting with the other participants, while each having their own set of preferences and goals. The balance between them is only maintained as long as the respective party receives what they feel is acceptable compensation for the use of resources required by the relationship. The relationship tends to fall apart if the contribution/compensation-ratio is not above the acceptable level. (Mattson 2002)

Thus, the relationships between customers and suppliers are affected by the division of power (ref. P-A theory perspective and Porter's Five Forces model). One can say that the balance of power regulates the relationship. This can be thought of as a scale of weights where customer efficiency factors are e.g. that the customer is responsible for a large part of supplier sales, the products are sensitive to price and it is easy for the customer to find alternative supplier at low exchange costs. On the other hand supplier efficiency factors could be few alternative suppliers existing, lack of substitute products and supplier's product being important for

customer image and quality. These aspects may result in the agency problem described by the Principal-Agent theory. As the supplier (agent) is aware of how dependent the customer (principal) is on the supply of certain products, the largest risk is with the customer, and the supplier may be tempted to pursue own interest, e.g. increase prices etc. Approaches to such problems will be discussed further in relation to Kraljic's portfolio approach (chapter 3.3).

Regarding the balance between customer and supplier, four relations of power are of interest; dominance, inferiority, cooperation and conflict (Mattson 2002). The dominant relation is often characterized by the small supplier and the large customer, and the agreement on cooperation is to a great extent dictated by the strongest part. When this dominance is present prices and terms of delivery are often dictated by the customer. The inferior part, in this case the supplier, must accept these terms in order to stay on the customer's list of suppliers.

In relationships distinguished by cooperation the interested parties have an equal division of power or the dominating part acknowledges the fact that even he will benefit in the long run from working under similar conditions.

Relationships may be dominated by conflict due to difficult negotiations concerning profit sharing, returned deliveries, credit invoicing and damage responsibility.

Another important characteristic in supply chain relations is the existence of bonds. Such bonds can be of different kinds and have different functions. They represent strong connecting forces within the supply chain, but also limitations for the participants' freedom of action. Mattson (2002) has identified a set of bonds relevant in supply chain relationships; technical, knowledge based, social, juridical, economical, market based, IT (Information Technology) based and time based.

Technical bonds are often represented by the customer and supplier adjusting their materials, equipment and production methods to each other.

Knowledge-based bonds are the result of the customer and supplier gaining knowledge about each other's businesses. This is often seen as an investment as it can make adjustments and problem solving easier.

Social bonds emerge over time between individuals in customer and supplier companies. One knows whom to contact to solve a certain task. These social bonds also result in the creation of trust between the parties involved. On the other hand, too close social bonds may lead to negative consequences as formal procedures may be omitted as a result of informal exchange of information.

Juridical bonds are contracts and other agreements between customer and supplier, often also intended to secure long time commitment.

Market based bonds are in example related to the status or image being the supplier to a company with a brand name, thus possibly creating goodwill for the supplier.

IT-based bonds exist if a customer and a supplier invest in a common system for information exchange and communication standard. This can be EDI¹⁹-based communication requiring adjustments to standards, systems enabling communication between each others administrative systems, or software.

Time based bonds are a more vague type of bond. They generally include coordinating supply chain activities and delivering products within appointed time schedules. (Mattson 2002)

Several types of bonds often exist simultaneously and they can also be seen to amplify one another. In the process of establishing technical or IT-based bonds, knowledge-based bonds often occur as a result of exchanging information and adapting procedures. Consequently, social bonds may emerge as most processes require involvement of key personnel. Similarly, juridical and market-based bonds are connected as the use of e.g. brand names often is restricted by contracts.

¹⁹ EDI (Electronic Data Interchange) is the transfer of data between different companies using networks, such as the Internet. As more and more companies get connected to the Internet, EDI is becoming increasingly important as an easy mechanism for companies to buy, sell, and trade information (Webopedia – www.webopedia.com)

2.3.5 Relationship Levels

In 1991 Giorgio Merli²⁰ (Mattson 2002) identified three types of relationship “levels”. At the lowest level suppliers are called “conventional” suppliers, characterized by occasional orders and the price being the deciding parameter. The customer has its own quality control and safety inventory to handle delivery uncertainty.

At the next relationship level suppliers are “associate” suppliers. These relationships are characterized by being long-term and periodically revised. Quality is guaranteed by the supplier and the customer in principal does not need to control the quality of deliveries. Orders and deliveries are frequent, and the flow of products and information between the companies is synchronized as far as possible. The ideal delivery is directly to the factory floor or distribution inventory. Together customer and supplier try to reduce inventory and lead times²¹, as well as the need for buffer to handle uncertainty. The price is no longer the only aspect in deciding which supplier to use.

At the highest level suppliers are “partnership” suppliers. In addition to the characteristics of “associate” relationships there is joint product development and frequent information exchange concerning production processes, products and quality. Investments in new technology and improvement efforts are often also common, and the supplier is deeply integrated into customer logistics.

The first relationship level (“conventional”), and to a certain extent the second level (“associate”), are often related to suppliers of standardized products. Regarding suppliers of more specialized goods, all three relationship levels have been seen to apply. The production of specialized goods generally increases the importance of precise and clear communication. Hence, having “associate” and “partnership” level relationships with suppliers of specialized products is considered advantageous. Establishing such relationships with suppliers of standardized products critical to a company’s production can also be favorable. (More on this subject in chapter 3.3 “Behavior towards Suppliers”)

²⁰ Giorgio Merli is Country Leader of IBM Business Consulting Services Italy and Solutions&Alliances Leader for the EMEA (Europe, Middle East and Africa) region. He was President and CEO of PriceWaterhouseCoopers Consulting (PWCC), Italy and EMEA responsible for the Operations Strategies service line of PWCC.

²¹ Lead time is a span of time required to perform an activity. In a logistics context, it is the time between recognition of the need for an order and the receipt of goods. Individual components of lead time can include order preparation time, queue time, move or transportation time, and receiving and inspection time. (APIC - American Production and Inventory Control Society.)

Jamie Flinchbaugh at “Lean Learning Center” (www.leanlearningcenter.com) introduces his article on dilemmas in supplier relationships (as appeared in “The Manufacturer of Michigan Journal”, December 2001) by asking whether suppliers are friends or foes. “There seems to be a great deal of confusion about how firms should be working with, or against, their suppliers. There is a great deal of conversation on the topic, but only one consistent theme seems to emerge: no one is satisfied with the current state of affairs” (Flinchbaugh 2001).

Flinchbaugh says that companies should ask themselves why there is any difference between supplier relations and customer relations. Most companies try to partner with their customers, understand their needs, integrate with their processes, and share information. The same companies often keep their own suppliers at “arms-length”.

2.3.6 Traditional Customer-Supplier Relationship

Stig-Arne Mattsson describes different types of customer-supplier relationships in his book “Logistik i försörjningskedjor” [Logistics in Supply Chains] (Mattson 2002). One of these relationships is characterized by the customer and supplier having a competitive relationship. Both parts try to reduce the others position of power as there is a game of win or lose. There is internal competition for the supply chain profit margin occurring when all costs are covered for all process participants. The principal argumentation is that the customer pays for the supplier profit; the higher supplier profits the lower the customer profits.

This type of relationship is described as the traditional customer-supplier relationship. The forces working in these types of relationships can be illustrated by Michael Porter’s Five Forces analysis. According to Porter (1998) the rules of competition are embodied in five competitive forces; the entry of new competitors, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers, and the rivalry among existing competitors. This is the situation regardless of industry, whether it is domestic or international or produces a product or service. Thus, the Five Forces model presented below (Figure 2-3) illustrates the connection between new competitors, substitute products, supplier bargaining strength, customer’s bargaining strength and identified competition from existing competitors. The model shows which forces affect profitability and thereby also which forces represent a threat to company sustainability and growth.

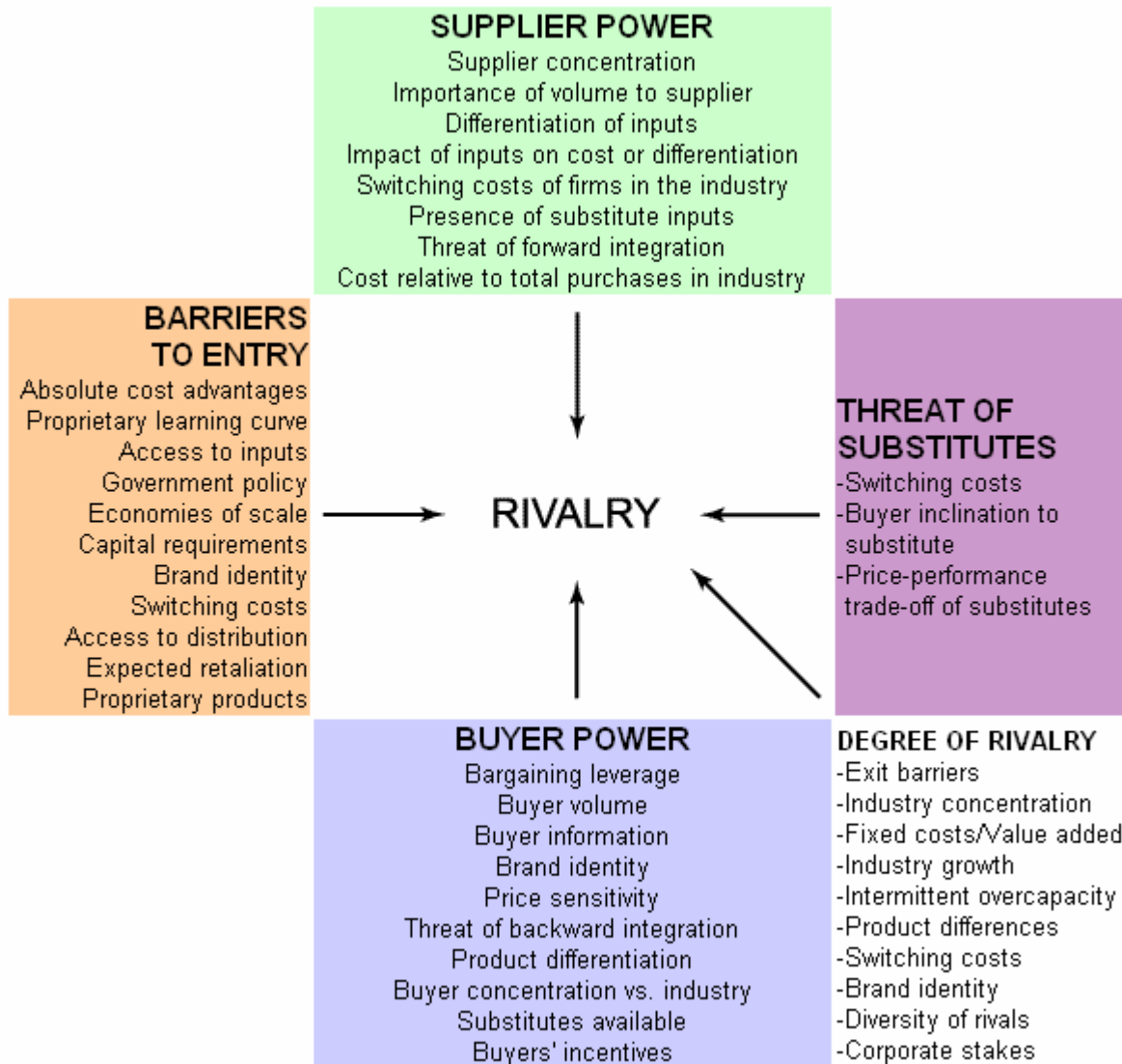


Figure 2-3 Based on Michael Porter's Five Forces Model

("Porter's Five Forces" from QuickMBA: Strategic Management, 1999-2006, 3 Feb. 2006)

Source: www.QuickMBA.com/strategy/porter.shtml

Original Source: (Porter 1998)

The 5 Forces model shows that company profitability and growth is dependent on customer and supplier bargaining strength. It follows that, in these traditional type customer-supplier relationships a company will work to reduce the power of and also reduce own dependence on the opposite party. For the company this means wanting several suppliers capable of delivering the same product and the cost of terminating a supplier relationship being low. It follows that upstream supply chain integration might represent a threat as agreements between sub-suppliers may lead to impaired bargaining strength. Thus, long-term contracts with

suppliers will preferably be avoided as this increases dependability, reduces own bargaining strength and makes terminating the relationship more difficult.

In the traditional customer-supplier relationship the supplier will also try not to have only one major customer to avoid being too dependent on this customer regarding capacity utilization. The supplier will in this sense also benefit from achieving high cost of relationship termination.

There are several risks tied to traditional customer-supplier relationships as the market of suppliers may become too fragmented. Smaller suppliers and the continuous pressure to reduce prices may reduce their ability to further develop their products and gain technological competence. This type of relationship provides poor conditions for efficiency improvements in the supply chain. Such improvements always depend to a certain degree on trust-based relationships with a high level of commitment. This is hard to achieve with the traditional customer-supplier relationship. (Mattson 2002)

2.3.7 Customers and Suppliers as Partners

Influenced by just-in-time and the Toyota production philosophy a new type of customer-supplier relationship was developed during the 1980s. Customer and supplier are now seen to enter a partnership where both parties play a win-win game. Together they try to increase the total competitiveness of the entire supply chain and thereby also increase the total profit margin. Commitment, trust and long-time aspects are key words in this type of relationship. For the customer this means establishing partnerships with a smaller number of suppliers to secure close bonds and simplify efficient supplier development. This implies moving from market-based relations discussed by the Transaction Cost theory to network-oriented relationships analyzed in a Network Based theory perspective. Long time agreements are considered favorable for both customer and supplier, and it is in the supplier's interest to contribute to the customer's competitiveness.

The risk of committing to such relationships is related to the close bonds between the two parties. These bonds are often difficult and time-consuming to break and replace, based on the degree of cooperation (how dependent they are on each other). If the customer and supplier adjust their production technologies and choice of materials to accommodate one another, it

would normally be very difficult and expensive to end the relationship and replace it with a new one.

What mainly characterizes a partnering relationship is the demand for mutual trust, undertaking and risk sharing as well as participating to a certain extent in each others business tasks. It is based on an intimate exchange of information (often confidential), services and sometimes products. The American National Association of Purchasing Management (NAPM) defines such partnerships as “a cooperative and collaborative way in which buying firms and key supplying firms intensively interact with each other to achieve mutual win-win long term competitive benefits” (Mattson 2002). This definition supports the basis of SCM emphasizing the importance of long time commitment and cooperation to create positive outcomes for all supply chain participants.

So why do companies choose to become “partners” with their suppliers or customers? The idea is that in today’s competitive market situation companies are forced to be stringent on the use of resources, obtain and sustain high quality and delivery security etc. The integration of companies and control systems are helpful tools in complying with these requirements. In the view of the supplier the first and foremost reason to engage in such a partnership is to secure the future market for their products. Another reason is to contribute to the quality of the customer’s product as well as making the flow of materials, information and service more efficient. The latter is in accordance with the just-in-time production philosophy supported by easier access to prognosis and other information important for predicting future demand. Reducing transaction costs (in example job and invoice costs) is also a common motive. All together, by contributing to customer improvement and growth the supplier can improve its own chances for success. In customer perspective the two main reasons for engaging in partnerships with their suppliers is reducing the total cost of purchased products as well as securing a reliable supply of materials and products. Other motives are the ability to influence quality and time of delivery, and gaining access to suppliers’ technology and know how. (Mattson 2002)

2.3.8 Traditional vs. Partnership Relations

The relationship based on partnering does to a substantial degree exceed the traditional customer-supplier type relationship in meeting the criteria for developing and sustaining an efficient value-creating supply chain. The SCM and process oriented view is supported,

understanding that it is the total competitive strength of the entire supply chain that is crucial for becoming successful. It is worth noting that improving supply chain efficiency is possible also within the traditional customer-supplier relationships, if certain conditions such as adequate communication and willingness are present. But it still contradicts the elementary principles regarding the totality and flow based thinking SCM is built on. Most companies (e.g. in the automotive industry) that have developed and implemented advanced SCM have a more strategic partnership and cooperation oriented view of their customer-supplier relationships.

2.3.9 Other Aspects Affecting Supply Chain Relationships

A study performed by Rosabeth Moss Kanter²² (1994) investigates how partnerships work. Following this study she has stated a set of eight criteria necessary to fulfill to succeed in such partnerships.

- Both parties being individually successful and able to contribute to the cooperation.
- Partnership being a part of both parties' strategies.
- Both parties being mutually dependent on each other.
- Both parties "investing" in each others enterprise.
- The existence of openness in exchanging information.
- Integration of the enterprises on different levels of the organization.
- Formalized and distinct agreements on responsibility and decision making.
- Mutual trust and the effort of supporting each other being present.

Kanter's eight success criteria can be seen in relation to the Principal-Agent theory and Network Based theory perspectives. Both parties being mutually dependent, and the existence of openness in exchanging information, may reduce fear of opportunistic behavior central to P-A theory. Further, formalized agreements on responsibility and authority may contribute to the handling of a potential agency problem. The other criteria are adjacent to the NB theory perspective. Equal abilities to "invest" in each other's enterprises and contribute to the cooperation are potentially crucial premises for the success of the partnership. Further, mutual

²² Rosabeth Moss Kanter is Professor of Business Administration at Harvard Business School. She is former editor of the *Harvard Business Review*, a consultant to major corporations around the world, and author of 13 books. (Leader to Leader Institute, NY, USA) (The Leader to Leader Institute is an organisation seeking "to strengthen the leadership of the social sector" by providing educational opportunities and resources to leaders.)

trust and distinct strategies regarding commitment may contribute to the integration of the enterprises enabling productive and efficient cooperation.

In addition to this it is important that both parties shortly see positive effects of working together. If not, powers working against organizational changes can become too strong and damage the opportunities of a good and healthy relationship.

Those customers succeeding in partnerships (achieving improved quality and reduced costs) emphasize open exchange of information, support from management, similar goals and the wish of the supplier to create excess value as crucial factors (Kanter 1994). The suppliers agree on these factors, and add the existence of a continuing relationship between purchase and sales. In cases where the customer-supplier partnership has failed the parties considered poor communication, lack of support from management, bad planning, broken trust and lack of conflict handling mechanisms being the main reasons.

Long time commitment and being dependent on one another are important aspects in creating successful partnerships. But in some situations long-time partnerships can also be negative. Whether the relationship in question is a partnership or not; there will always to some extent exist both similar and contradictory interests. Difficulties may arise when one of the parties wishes to end the relationship while the other wishes to continue. Another situation is when all parties wish to terminate, but it is impossible or very costly or time consuming because of the strong sense of dependence. Long-time partnerships can also lead to restricted supply of new ideas and knowledge as customer and supplier may be more inward focused. According to Mattson (2002) contradictory interests are rarely discussed in the literature on customer-supplier relationships. But the presence of such challenges is often a natural element and should be dealt with in concrete situations, especially from a strategic point of view.

On the other hand there may also be factors emphasizing the independence between the parties. If the supplier only accounts for a small part of the total purchase costs, or the risk that the customer is exposed to if the supplier fails is low, or there are low exchange costs and several substitute suppliers, the customer is to a certain degree independent of its supplier. In these situations market-oriented relations, which in nature are short-term, may be preferable. From a supplier perspective, if the customer is only responsible for a small part of total affairs and the termination of the relationship is of less importance concerning financial results and

also at the strategic level, it is to an extent independent to its customer. Other aspects affecting the supplier's independence from a certain customer may be lack of competition as well as product differentiation and cost leadership.

3 Managing Supply Chain Relationships

Chapter 2 has defined and discussed central concepts in Supply Chain Management. Chapter 3 will discuss relevant SCM theories more, especially aimed at establishing a deeper understanding of strategic approaches to customer-supplier relationships and supplier development. The chapter will conclude with research questions for the following empirical investigation.

3.1 Supply Chain Optimization

Supply Chain optimization can be described as the coordination of linked resources across all or parts of a supply chain in eliminating or reducing manufacturing and logistics bottlenecks and creating optimized schedules based on shared inventory and order information.

The article by Rudzki et al. introduced in section 2.1.2 has the title “Supply Management: How Are You Really Doing?” The authors emphasize the fact that competition is no longer company to company but rather supply chain to supply chain. “The company that does the best job of integrating its supply network – in terms of objectives, strategies, processes, and data linkage – creates optimal competitive advantage for the entire supply network and optimal value for its shareholders and customers.”

These are normative claims from consultants with a product/service to sell. Still it is supported by supply chain professionals emphasizing that efficient management of suppliers is a vital source of cost reduction and quality improvement.

Rudzki et al. argues that a critical indicator separating stagnating organizations from those having a chance to succeed is the answer to the question whether supply chain goals are integrated into the strategic plan of the business. Being able to respond positively to this question indicates that the company understands the potential benefits on the supply side of the organization.

Large companies making a lot of money may often pay less attention to costs. But by not succeeding in reaching their full potential they are failing their fiduciary responsibility to the shareholders. Disregarding the supply side of the company leads to missing out on an opportunity to influence one of the most important drivers of bottom-line growth. Working the right way with well chosen suppliers will help every company achieve better results.

Once a company has committed to the concept that supply chain management is a critical component of corporate success there are important steps to consider. It is important to establish clear and measurable goals as well as making sure that supply chain management is appropriately aligned in the company. In today's environment it is also particularly important having the right tools and training in place. (Rudzki, Smock et al. 2005)

The idea of Supply Chain Management being a critical factor in achieving corporate success is supported by Minahan²³ (2005). He identifies several competencies that companies need to develop to transform their procurement and supply chain activities into strategic resources and generators of real business value. First and foremost he emphasizes the importance of improving supplier development and collaboration. Other competencies include enhancing and integrating procurement automation infrastructure as well as the transition to a centre-led procurement organization. The Aberdeen Group has identified companies that have developed such competencies as "supply management leaders". They are leaders due to the fact that they have built up a strong competitive edge over the average companies.

The shift from traditional procurement practices to more strategic supply management represents a fundamental change. The biggest roadblock is often seen to be the built-in resistance to change traditional thinking into new mindsets regarding supplier relationships.

The best engineering solution may not be the optimal solution from a supply chain point of view. By involving supply chain functions at an early stage, a company can take advantage of its relationships with suppliers. The end result: Customers get products that meet their

²³ Tim Minahan is Chief Services Officer within the Aberdeen Group, tracking spending analysis, sourcing, procurement execution etc.

specifications, the company optimizes its use of its supply chain, and suppliers participate according to their strengths. (Minahan 2005)

3.2 Supply Chain Obstacles and Possible Solutions

“The Supply Chain Manager’s Problem-Solver: Maximizing the Value of Collaboration and Technology” by Charles C. Poirier²⁴ (2003) provides a perspective on the biggest obstacles and possible solutions existing for companies trying to realize the total benefits offered by supply chain optimization.

Poirier argues that obstacle number one is lack of leadership vision. Results presented in magazines, journals, newspapers and books testify to the validity of supply chain management and its potential to reduce costs while generating new revenues, higher profits and greater customer satisfaction. Understanding underlying concepts of SCM and the improvement potential it represents for the company is vital. By articulating a vision for supply chain optimization and constantly reinforcing this vision through direct involvement and sustained effort, the biggest mistake in supply chain management may be eliminated. (Poirier 2003)

Another mistake is using wrong or different performance measures, as companies often head in the direction determined by what is being measured. Supply chain vision and effort should therefore be supplemented with a uniform set of performance measures supporting proper behavior. Traditional measures will never be eliminated, especially those relating directly to financial performance. Such measures often lead to short-time focus as employees strive to reach targets within the ongoing period. Establishing additional and more long-term measures specific to intentional supply chain objectives should be applied to all relevant functions.

Mistake number three is according to Poirier (2003) aversion to external advice and keeping relevant information too close to the chest. Sharing information on processes like sales forecasts, inventory management, order processing, scheduling and planning, warehousing and shipping contributes to predictability and efficient cooperation. In addition, applying

²⁴ Charles C. Poirier has performed many years of in-depth research, interviews with key players across the supply chain spectrum, case study analysis, and hands-on experience spanning a wide number of industries and firms.

cyber-based techniques supports supply chain optimization in areas like order entry, order management, design and development, cycle time reduction, logistics improvement etc.

The list of obstacles continues, emphasizing aspects like poor customer relationship management and lack of trust and collaboration across the supply chain. Supply chains require both internal and external cooperation. Poirier argues that with so much happening in today's economy, the path to the future is best traversed with the help of willing trading partners who share good ideas. Working more closely with partners throughout the supply chain begins inside the company and progresses with the help of trusted allies. Raising the level of trust within the company and with external partners by sharing information critical to more efficient processing is vital. The total becomes an enhanced network providing the kind of services sought by today's customers.

By focusing on supplier development customers can help improve their suppliers' operational ability. Building a more capable supply base will in many cases contribute to a company's competitive power. According to Jamie Flinchbaugh from "Lean Learning Center" no one does this better than Toyota. The Toyota Supplier Support Center (www.tssc.com) trains and supports their suppliers' development especially in the application of the Toyota Production System²⁵. In addition, internal operational resources are used, helping suppliers deepen their understanding through the teaching process. This approach has made Toyota's supply base the most competitive in the industry.

3.3 Behavior towards Suppliers

As mentioned before suppliers are in general regarded as important for the success of a company. Choosing and establishing a policy for how to behave towards suppliers then plays a vital part in the company's own efficiency and competitiveness. The policy is characterized by being somewhere between exercising force and directive, and total partnership and solidarity.

²⁵ Toyota Production System (TPS) is the framework and philosophy organizing the manufacturing facilities at Toyota and the interaction of these facilities with the suppliers and customers. It was largely created by three men: the founder of Toyota, Sakichi Toyoda, his son Kiichiro Toyoda, and engineer Taiichi Ohno. The main goal of the TPS is to eliminate waste. Toyota was able to greatly reduce cost and inventory using the TPS, enabling it to become one of the ten largest companies in the world. The TPS is a classic example of the Kaizen (continuous improvement) approach to productivity. Due to this stellar success of the production philosophy many of these methods have been copied by other manufacturing companies. TPS is known more generically as Lean manufacturing. (Wikipedia)

Establishing partner-based customer-supplier relationships is a continuous and costly process requiring both time and resources. Therefore it is not possible either to establish a partnership as described above or integrate the value-creating operations and flow of materials with a large number of suppliers. Thus, reducing the number of suppliers, creating system suppliers (suppliers who manage a set of sub-suppliers and deliver assembled systems) or focusing on strategic suppliers (with reference to Kraljic's portfolio approach) is essential.

The challenge of having a large number of suppliers can be managed by e.g. including the suppliers responsible for the highest volumes in partnerships. But high production volumes are not automatically the same as high transaction volumes and transaction costs. By focusing only on production volume one might not see the total potential of supplier improvements. Also suppliers that are substantial for the company at a strategic level should be included in partnerships.

Choosing a relationship level can be supported by a matrix model (Figure 3-1) established by Kraljic²⁶ (1983). Basis for the model is a purchasing portfolio approach. Kraljic introduced the first comprehensive portfolio approach for the determination of a set of differentiated purchasing strategies and a policy for the more fundamental restructuring of the portfolio as a whole. He advised managers to guard their firms against disastrous supply interruptions and to cope with changing economics and new technologies. His message was "purchasing must become supply management". Kraljic proposed already in 1983 a four-stage approach as a framework for 'shaping the supply strategy': (1) Classify all the purchased materials or components in terms of profit impact and supply risk, (2) analyze the supply market for these materials, (4) determine the overall strategic supply position, and (4) develop materials strategies and actions plans.

Power and dependence issues play an important role in Kraljic's approach. In this sense, Kraljic's portfolio approach can also be seen in relation to the Principal-Agent (P-A) theory perspective, as it seeks to determine the most efficient customer-supplier relationships based on the degree of customer dependency of the suppliers' products. Coherent with the P-A

²⁶ In 1983, the McKinsey consultant Peter Kraljic wrote an article for Harvard Business Review titled "Purchasing Must Become Supply Management." Kraljic laid down the fundamental principles of modern strategic sourcing, arguing that the purchasing function should take the strategic role of supply management.

theory is the recognition of strong dependency leading to higher risk, and the fear that agent (supplier) may behave opportunistically.

In Kraljic’s approach, purchased products are characterized by their significance for the company in respect to their availability in the market. Significance for the company is related to profit impact (production costs and criticality for quality and performance) and product availability to supply risk (number of suppliers in the market offering the product).

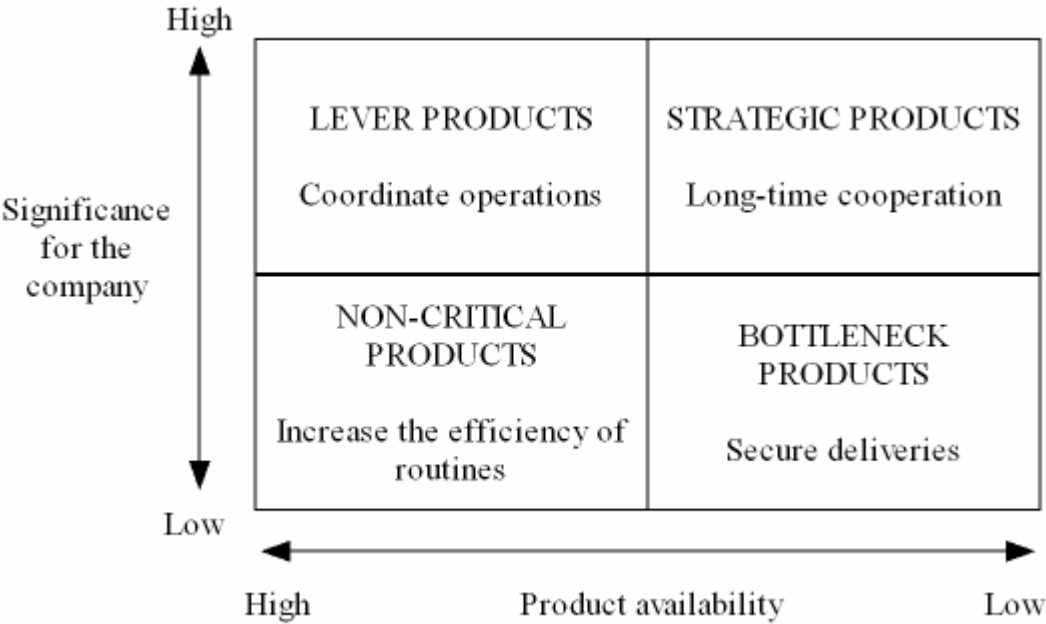


Figure 3-1 Based on Kraljic’s portfolio approach

Source: (Mattson 2002)

As understood by the matrix model e.g. lever products are products with great significance for the company and market availability is high.

Each of the four categories requires a distinctive approach, in a strategic view. The strategic approach to non-critical items is “simplification”. This requires efficient processing, improvement of logistical and administrative cost drivers, product standardization (possibly increased order volume) and inventory optimization.

Leverage items allow the buying company to exploit its full purchasing power, for instance by tough negotiating, target pricing and product substitution. Thus, the strategic approach is

“price leverage” suggesting making use of competition and concluding long-term buying agreements with the best price.

Bottleneck items on the other hand may represent significant procurement risk. The strategic approach is to “minimize risk” e.g. by replacement or redesign. According to Kraljic volume insurance, vendor control, security of inventories and backup plans are recommended.

Strategic products are seen to be the most critical components as there is substantial both procurement risk and business impact if a supplier fails to deliver (e.g. not in time, poor quality etc.). The strategic approach to strategic components is “building alliances”. This implies establishing long-term relationships, alliances and contracts.

When choosing relationship levels it is first and foremost for products with low availability one should seek to develop partnerships. This is supported by the Network Based theory arguing that strategic networks are seen to provide companies with important and valuable resources. The objective of the partnership is to secure deliveries of bottleneck products as well as important strategic products (high volume etc.) in a seller’s market.

On the other hand, high product availability leads to a buyer’s market. In these cases a partnership is not necessary, and maybe even unfavorable. A close relationship with a supplier can in this situation reduce the company’s bargaining strength and thereby the opportunity to negotiate lower prices and better terms of delivery. Still within the supply chain it might be more important to coordinate the flow of materials and information than tying up in relationships that are costly and time-consuming to terminate. (Kraljic 1983)

But it is not only product availability and significance that are important aspects in choosing to what extent a company should cooperate with its suppliers. With reference to Williamson (1975) acquisition frequency and degree of customer specified products are important aspects. Regarding customer-supplier relationships, developing close partnerships is most interesting when purchases are repeated over a substantial period of time. The objective of engaging in partnerships in this situation would be to establish efficient procurement processes (standard products) and further engage in cooperation in the product developments process, from product specification to the transfer of construction drawings and requirements etc. (customer specific products). If the relationship is only characterized by a one-time purchase simple

agreements with suppliers should normally be sufficient, especially if the product has limited significance for the company. Establishing internal guidelines for supplier qualification and the procurement process is in all cases important. (Mattson 2002)

It is worth noting that there are both benefits and drawbacks with the types of models like Kraljic's portfolio approach. The advantage is that they show the strategic importance of product acquisition, and provide a chance of increased specialization within the procurement function. It is a relatively simple tool; the world is complex and must be simplified to be manageable. Also, the models focus on some important aspects, even though these aspects may not be the most important or the only ones that are important. This introduces some of the problems with such models. The dimensions in the matrixes are aggregated measures of sets of factors that are often difficult to measure, and it may be difficult to place products and suppliers in one distinct frame. Thus, strategies may become ambiguous as they are based only on the classification of products/suppliers. Further, focus is on given products, and no attention is paid to product development aspects. Also, the models imply significant focus on classification, but little on implementation (how to implement given strategies).

All companies are engaged in different supply chains, both as customers and suppliers. Developing relationships based on efficient flow of information and products is important in achieving competitiveness and profitability within the supply chain. The next chapter will consider different methods for making administrative processes more efficient.

3.4 Developing Efficient Supply Chains

This chapter rounds off the theoretical foundation of this master thesis by considering methods for making supply chains more efficient, hence contributing to the competitiveness and profitability in a company and supply chains as a whole.

Supply chain professionals offer a few "keys to success" (seen from the customer company) for building an enabled supply chain:

- Think shared benefit ("something in a process for everyone in that supply chain"). This is central in theories such as Network Based theory as well as SCM-literature.

- Buy-in starts from the senior management. SCM-literature emphasizes the importance of SCM being rooted in and encouraged by the company's senior management.
- Educate and train all supply chain stakeholders. Increased understanding of supply chain dynamics is considered crucial when seeking to align processes in order to build a more efficient and profitable supply chain. This emphasizes the importance of educating and developing suppliers.
- Start small, but be prepared to expand rapidly. It takes time to build relationships based on trust, but as they are established they are likely to shortly show positive results.
- Ensure that different supply chain functions are not implementing incompatible solutions. This refers to the importance of superior supply chain management.
- Make sure your key suppliers are ready for e-business, providing opportunity for efficient management of the supply chain.
- Make sure your data is clean before you rely on it.

Unclean data, such as incorrect or incomplete data on purchase orders, specifications and non-conformance obtained from e.g. ERP-based systems like SAP²⁷, can lead to misunderstandings and errors in production. This again may lead to a disagreement whether the customer or the supplier is responsible for the errors made, and who must cover the financial losses. Avoiding such errors by operating with clean data will lead to improved performance regarding both quality and on-time deliveries.

E-business is an important part of an efficient supply chain, as suppliers can obtain information on forecasts, orders, logistics etc. Business conducted using electronic media as the Internet or other computer networks supports supply chain optimization as the exchange of information becomes more efficient.

Buy-in from senior management is a key element in achieving the goals of organizational effort such as changes made to achieve efficient supply chains. Working for continual

²⁷ ERP (Enterprise Resource Planning) systems are software systems that are used for operational planning and administration and for optimizing internal business processes. The best-known supplier of these systems is SAP. SAP is the name of the biggest European software company. The head office is in Walldorf, Germany. SAP was founded in 1972 as Systemanalyse und Programmentwicklung ("Systems Analysis and Product") by five former IBM employees in Mannheim, Germany. (Wikipedia)

improvement within supply chains requires support from the entire organization as the way of thinking and addressing challenges must be altered. Support from senior management through design/engineering, logistics, production etc. is vital.

Education and training is the basis for supply chain improvement. People cannot deal with things they have no or insufficient knowledge of.

The implementation of incompatible solutions both internally and in relation to suppliers may lead to problems exchanging information. Through communication one can find common and suitable solutions, and such problems can be avoided. Establishing an agreement on supply chain solutions is also favorable as willingness to adapt and implement the solution may increase.

Supply chain improvement processes may start in small scales, but expand as the company and its suppliers start seeing the shared benefit of the effort. Keeping in mind that such processes imply a win-win game supports the effort of working for continual improvement.

A company's ability to establish cooperation and improve efficiency within the supply chain depends on their attitude towards the different participants. The literature emphasizes the importance of having two-way communication between customer and supplier to ensure that both parties are heard and both views are taken into consideration. The main objective is to develop forms of cooperation leading to improved results for both customer and supplier. Being a world class leading company requires having world class leading suppliers. This works both ways; acquiring world class suppliers means behaving like a world class customer (Mattson 2002).

3.5 Issues to Be Addressed

With the foundation provided the following research questions will be addressed in this master thesis. Answers to these research questions seek to help improve FKS' supply chain management and supplier relationships.

- 1. How does FKS organize the handling of suppliers? (Identified by analyzing the established process of procurement)**

- a. How are FKS suppliers organized in relation to FKS – e.g. vertically integrated or subcontracted?
 - b. The process of procurement - How does FKS communicate with suppliers? Is the procurement process similar to the *procurement life cycle* described in chapter 2?
 - c. Strategic approach to types of suppliers - Have FKS classified their suppliers according to Kraljic's division or by use of other criteria? What strategies apply to the different types of suppliers; market-based (conventional/"shopping"-oriented) or network-based (associate and partnership-oriented)? Are aspects of power and dependency seen to affect these relationships?
- 2. Where are the main weaknesses in FKS' supplier handling? (Determined through empirical investigation and analysis)**
- a. Are strategies regarding supplier relationships rooted in top management, and clearly communicated throughout the organization and to relevant suppliers? Is cooperation with suppliers of products with high significance (e.g. strategic and bottleneck products) for FKS sufficiently close (with reference to Kraljics portfolio approach)? Are processes with suppliers of standardized products simplified to reduce use of unnecessary resources?
- 3. Which methods are suitable to improve FKS' supplier handling? (Answered with basis in empirical investigation and analysis and seen in connection with theoretical foundation)**
- a. Can theoretical approaches to supply chain management and theories on customer-supplier relationships presented in the theoretical foundation of this master thesis provide possible methods to improve FKS' relationships with their suppliers?
- 4. Which actions could a SCM improvement project consist of for FKS?**
- a. Suggestion for a way forward based on results.

Main weaknesses/improvement areas as well as potential benefits of improved supplier handling has been investigated both from FKS suppliers' and internal view. Basis for investigating these matters both internally and externally is to examine if responses correspond. Corresponding responses will testify to the reliability and validity of the obtained information.

4 About FMC Technologies and FMC Kongsberg Subsea

FMC Kongsberg Subsea is part of FMC Technologies. This chapter will describe FMC Technologies' business units, operating locations and some financial figures as a background for the empirical analysis.

4.1 About FMC Technologies, Inc. (FMC TI)

FMC (originally Food Machine Corporation) started business in 1883 with improving insecticide spray pumps. Today, FMC is divided into two independent companies; FMC Corporation (chemicals business) and FMC Technologies (machinery business). FMC Technologies, Inc. (www.fmctechnologies.com) is a global leader providing technology solutions for the energy, food processing and air transportation industries. FMC Technologies design, manufacture and service technologically sophisticated systems and products for its customers through its Energy Systems (comprising Energy Production Systems and Energy Processing Systems), FoodTech and Airport Systems businesses. FMC Technologies employs approximately 10,000 people and operates 32 manufacturing facilities in 17 countries.

FMC Technologies supplies among others oil and gas exploration and production equipment for land (onshore) and offshore (sea) applications, and subsea production systems. Business units of FMC Technologies are shown in Figure 4-1.


<p>Subsea Systems - The leading manufacturer and supplier of subsea production systems, including subsea trees, controls...</p>		<p>Surface Wellhead - A long history of technological innovations - from the 5K wellhead in the 1930s to the introduction of multiple-completion systems...</p>	
<p>Fluid Control - Plug and Ball Valves, Actuators, Swivel Joints and Pumps...</p>		<p>Loading Systems - FMC Technologies is the oil and gas industry's leading supplier...</p>	
<p>Measurement Solutions - The world leader in flow measurement and control of petroleum products since 1933.</p>		<p>Floating Systems - The global supplier of SOFEC® marine terminals, turret mooring systems & spread moorings.</p>	
<p>Material Handling Solutions - State-of-the-art technology and superior execution.</p>		<p>Separation Technologies - Design and develop state-of-the-art separators.</p>	
<p>Food Processing - FMC FoodTech, a leading supplier of integrated food processing solutions.</p>		<p>Airport Equipment & Services - Leading airlines, airports, and cargo companies rely on our products.</p>	

Figure 4-1 Featured Technologies

Source: www.fmctechnologies.com/subsea



Figure 4-2 FMC bases and entities worldwide

Source: www.fmctechnologies.com/subsea

FMC Technologies' subsea systems are installed in the Gulf of Mexico, the North Sea, the Grand Banks of Canada and the Asia/Pacific, as well as off the coasts of Brazil and West

Africa. Well known national projects are Statoil Gullfaks and Tordis and Norsk Hydro Ormen Lange.

FMC Kongsberg Subsea belongs to the Subsea Systems business unit. Other companies in the same business unit are located in Houston (Texas), Rio de Janeiro (Brazil), Singapore (R.S.) and Dunfermline (Scotland) (Figure 4-2).

4.2 About FMC Kongsberg Subsea (FKS)

FKS is one of the world's leading suppliers of innovative solutions for subsea drilling and completion systems, field developments, production systems and control systems. Product engineering is mainly performed at Kongsberg. FKS also provides customer support, spare parts delivery, on-site service and maintenance, and customer training.

Company vision is "We shall become our customer's most valued supplier through outstanding products, services and people". Basis for all activities is "HSE (Health, Safety and Environment) Focus In All We Do."

The company was originally the Oil division of Kongsberg Våpenfabrikk (KV) (Kongsberg Weapons Factory) in Kongsberg, Norway. In 1986 it was renamed Kongsberg Offshore AS, and in 1987 it was bought by Siemens as KV was divided into several different companies. In 1993 Kongsberg Offshore was bought by FMC Corporation, and in 2000 it was renamed FMC Kongsberg Subsea AS.

Due to the substantial growth from 2004 to 2005 FKS is now the largest manufacturing company in Kongsberg. Sales increased from approximately 0.69 to 1 billion US-\$, implying an increase of over 40%. According to the Financial Director of FKS, Pål Morstad, this increase includes operations in Norway, Scotland, Angola, Canada, Mauritania, Nigeria and the Ivory Coast (Knut W. Hermansen, Laagendalsposten February 18, 2006). Incoming orders increased from 0.96 to 1.05 billion US-\$, and EBIT (Earnings Before Interest and Taxes) increased from 40 to 50 million US-\$. Number of employees in Norway was approximately 1800 at the turn of the year 2005/2006. Approximately 1500 of these were employed in Kongsberg.

4.3 Products

The Subsea development started in the early 80's. The idea came with the discovery of "small" pockets of oil around a large reservoir (*small meaning not large enough to justify an installation of a permanently installed platform*). FMC subsea production systems are shown in Figure 4-3 (FPSO is not an FMC product). Products include tie-in and flow-line products, subsea trees, manifolds, drilling systems, control systems, completion and workover riser systems and well systems.

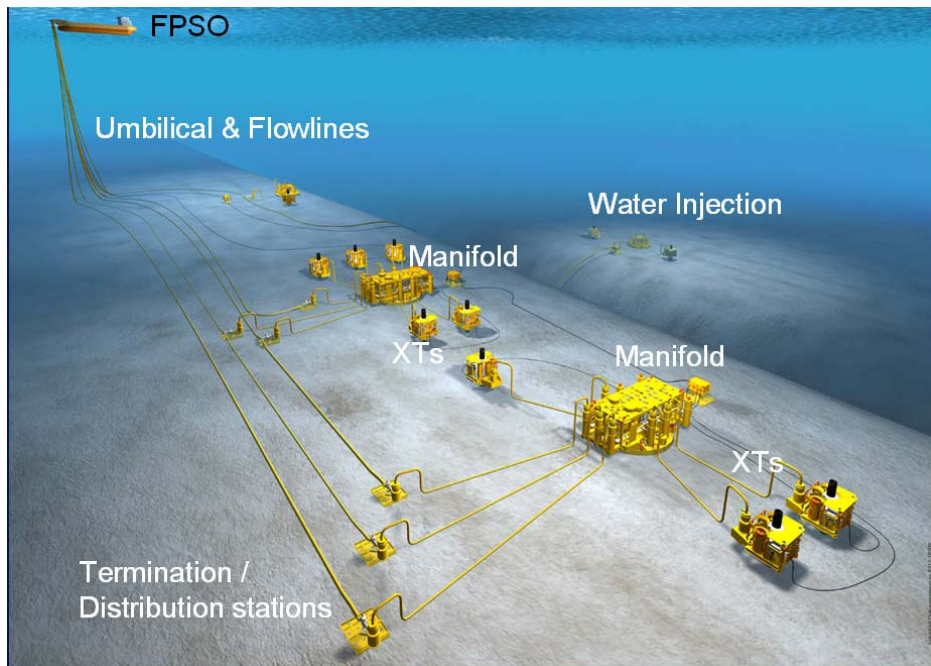


Figure 4-3 FMC subsea production systems
Source: www.fmctechnologies.com/subsea

These products require substantial product reliability and robustness;

- Up to 300 bar external and 1.700 bar system pressure
- Temperature range from -5 to 30 degrees Celcius
- Vibration, shock and chemical resistance
- Hydraulic cleanliness
- 25 years lifetime

Such requirements emphasize the importance of high quality components, and with that, high quality throughout the entire supply chain. A supply chain is no stronger than the weakest link (Mattson 2002).

4.3.1 Template and Manifold

The Template System consists of building blocks that are the foundation when developing a subsea field. The weight of the first templates, like SNORRE A (left in Figure 4-4) was 2000 tons. It is the largest Subsea template installed in Norway.



Figure 4-4 FMC Template (left) and Manifold (right) systems
Source: FMC Subsea Technology Introduction on E-learning, 2006

The new template systems have been standardized, and the weight on a 4 well HOST (**Hinge Over Subsea Template**) is down to around 200 tons. The picture on the right shows the OTTER template, it is a “Fixed HOST template” with suction anchors. (FMC 2005)

4.3.2 Drilling and Wellhead

FMC provides drilling equipment to suit the widest range of subsea applications. The systems have been developed with a modular approach using core standard field proven drilling and sealing technology. A choice of features can be built in, to optimize each system for its particular application. All systems are designed to be suitable for exploration drilling and completion operations. (FMC 2005)

4.3.3 X-mas Tree Systems

Today there are two subsea XT systems from FMC, Horizontal X-Mas Tree and Conventional X-Mas Tree. The XT is the main “valve” for controlling the well pressure during production. The XT is remote controlled and operated from the subsea control system. Each XT has a “unique” address in the control system. The “brain” in the system is the Subsea Control Module. (FMC 2005)

4.3.4 Workover System

A workover system is used for installing and maintenance. Generally, two different systems are used for Completion and Work-Over of either conventional or horizontal X-mas trees. The Completion and Work-Over system is generally divided into three sub-systems: Surface equipment, Riser system and Subsea equipment. (FMC 2005)

4.3.5 Intervention System

The Intervention Control System (ICS) is used to monitor and control Intervention tools and activities; deployment and retrieval of equipment such as Subsea Control Modules, Flow Control Modules and Pressure Caps, and also to perform pull-in and connection of Umbilical and Flow lines.

FKS products are based on high technology, and developed for use in several different and challenging environments, which require compliance with extensive sets of requirements. This is a challenge for the supply chain as whole, as these requirements apply to components at all levels. In addition to this, different customers often demand different solutions with different specifications and requirements. (FMC 2005)

4.4 Customers

FMC Technologies are engaged in global subsea projects delivering equipment to customers like Statoil, Norsk Hydro, Total, BP, Shell, ExxonMobil, Kerr-McGee, ConocoPhillips, Petrobras, Woodside Energy etc. The latest project is in cooperation with Statoil. According to a press release February 3, 2006 Statoil has signed a Letter of Intent with FMC Technologies to provide subsea systems for the Tyrihans Project in the North Sea. Worth about 230 million US-\$, the agreement covers assistance and maintenance of the facility during installation and operation.

4.5 Major Suppliers

A wide range of both national and international suppliers deliver components and sub-systems for FMC subsea solutions. National key suppliers are e.g. Aarbakke AS, Grenland Group, NLI Alfred Andersen in Larvik and NLI Odda. Purchases from suppliers equal approximately 70% of sales. FKS mainly performs assembly of purchased products, but also has some

production regarding X-trees and control systems. The Template-Manifold-Intervention (TMI) department has facilities for qualification and development. Houston and Dunfermline departments are more production-oriented, thus have slightly different challenges in their supplier relationships. Dunfermline e.g. is more restrictive and rigid concerning defects and errors on received products.

5 Organization, Procurement and Communication with Suppliers

This chapter provides a description of how suppliers in general are organized in relation to FKS as well as how procurement and communication with suppliers is conducted. The latter is based on an analysis of the FKS *Procurement Process* identified through the main FKS Business Processes. Finally, strategic approaches to different types of suppliers will be investigated.

5.1 Organization with Suppliers

FKS does not in itself manufacture products, but assemble components from suppliers into finished products, and sell these to the final customer. This implies that FKS and suppliers are organized by the principles of industrial subcontracting, and these relationships are seen to be affected by aspects characteristic to this type of organization. This is e.g. seen in relation to single and especially sole source suppliers²⁸ having strong positions in the relationship to FKS as FKS is strongly dependent on these deliveries. FKS attempts to establish closer relationships with such suppliers, and regulate these relationships with *frame* or *partnering* agreements. Other types of suppliers relevant for such agreements as well as typical contents will be described below.

5.2 The Procurement Process

FKS has identified a process that describes how purchases and communication with suppliers is organized. This process is a part of the main business process used in FMC Kongsberg Subsea.

²⁸ A supplier is sole source if they are the only one in the market delivering a specific product. A supplier is identified as single source if it has been chosen by FKS as single supplier of a product, due to e.g. price or quality assessments.

The Procurement Process describes how FKS is carrying out its processes for (1) Material Requirement Planning (MRP); (2) Evaluation of Requisitions; (3) Evaluation of Requests for Quotation; (4) Production; (5) Logistics; (6) Strategic Procurement; and (7) Supplier Development. Thus, the FKS process principally consists of the steps of the procurement life cycle presented in chapter 2.

The tactical procurement department analyzes MRP (Material Requirement Planning) data from SAP. Needs are aggregated, optimal (batch) volumes are proposed, and a requisition is sent.

Upon receiving the requisition, a purchaser checks the existing QSL (Qualified Suppliers List) for a possible supplier, and checks price and frame agreements. In a situation where a relationship to a suitable supplier is not yet established, searching for suppliers who can satisfy the requirements is necessary. In that case, a Request for Quotation (RfQ) is created by the tactical procurement department. Bid method is decided, and the RfQ is sent to the suppliers, upon which the suppliers process the RfQ. The tactical procurement department receives and evaluates all bids. Background reviews are conducted, consulting references for product/service quality etc., and a supplier is selected.

As a supplier is qualified (through quality management system audits, technical product/process qualifications etc.), and chosen for a project, negotiations are undertaken, and a contract or purchase order to acquire the product or service is completed. A kick-off meeting is performed, after which the contract or purchase order is executed. Upon delivery the product is inspected for approval. In cases where defects are detected, a non-conformance report is recorded, and further actions are determined based on the type of defect.

As the contract expires or the product or service is to be re-ordered FKS determines whether to continue using the same supplier or consider other suppliers.

In parallel to the process of acquiring goods, the Strategic Procurement department works to continuously improve both existing and new suppliers through a supplier development process. Initiatives and actions in relation to supplier development processes are based on any

problem that may affect any delivery to FKS, e.g. supplier performance measurements (quality, delivery precision etc.)

5.3 Strategic Approach to Suppliers

According to identified FKS business processes the role of the newly established Strategic Procurement department includes developing a supplier relation strategy as well as developing new and existing supply chains. Strategic Sourcing Leader within this department, John Bjarne Bye, explains that strategies regarding supplier handling are being established.

In principle these strategies are based on Kraljic's portfolio approach, but suppliers are not formally categorized this way. Thus, there has not been established any superior and formal strategy regarding FKS' relationships with their suppliers.

A procedure for determining supplier strategies that will be implemented in FMC worldwide is today a "working document". However, a set of criteria related to significance and performance measures have been identified. These criteria consider aspects such as

- Order volume and spend. High orders volumes and high spend indicate high significance.
- Capacity. Single/sole source supplier. Suppliers with high capacity utilization are considered critical, especially in cases where these suppliers are single or sole source of certain products critical to FKS deliveries.
- Delivery (long delivery times and/or critical/continual delays) and quality issues. Based on performance measures and used to indicate specific problem areas.
- Price increase.
- Internal issues creating a disharmonious relationship.

The criteria are identified in order to identify the criticality of suppliers (related to e.g. strategic significance or product availability) implying the need for closer cooperation and follow-up. They are also used as basis for establishing an "action list", seeking to contribute to the development and improvement of the relevant suppliers. The questions are to be answered through continual and scheduled supply chain analyses, reports from supplier, customer and other FMC departments, and macroeconomics.

5.3.1 FKS – Supplier Agreements

In cases where suppliers are considered critical based on the criteria listed above, *frame* or *partnering* agreements may be worked out. Frame agreements in general include agreements on deliveries and prices, technical issues, ethical standards, HSE (Health, Safety and Environment), duration of the agreement, criteria for cancellation, and identified limitations. Such frame agreements are intended to regulate the relationship between FKS and the supplier, and provide forecast and predictability. They agreements are often seen to apply to “associate” level suppliers.

The purpose of such agreements is described in the beginning of the agreement documents and can typically be formulated like this:

“FMC Kongsberg Subsea AS (FMC) and *supplier X* will work together in a trusting, open and goal-oriented style to create a broad based business relationship. The overriding purpose of the agreement is to provide lower prices, shorter lead times, secure delivery capability and secure quality in all parts of product and supply chain.”

Further, the scope describes products, specifications and quality specifications. Any changes are to be reviewed by the supplier and agreed upon by FKS and the supplier. Agreements regarding responsibility for supplying the relevant products are established; in general by the supplier manufacturing totally in house or by utilizing qualified subcontractors. Regarding capacity, FKS is committed to give the supplier information (forecast) about planned projects and the market situation. The supplier is thus committed to have the necessary capacity to deliver the forecasted deliveries. Products and services covered by the agreement shall be based on competitive prices and given conditions, and FKS and the supplier should work closely together to reduce unit prices if feasible.

In addition, the following areas are considered of great importance:

- FMC is to be early involved in the design of the supplier’s products.
- No changes to be made without FMC approval.
- Focus on the total supply chain (supply chain management) is to be emphasized.

In cases FKS and a supplier consider even closer cooperation and commitment necessary (e.g. due to the strategic or capacity-related significance of the product), a “partnering” agreement

may be established. In FKS, a partnering agreement is an expansion of a frame agreement. It includes specific measurable targets, a collaborating team should be established, and the agreement is to be safeguarded by a steering committee. In addition to the areas considered of great importance in relation to frame agreements, the following are emphasized to partnering agreements:

- The supplier is to be developed in coordination with the development of FKS. This is related to aspects such as capacity, infrastructure, use of IT-based systems etc.
- The most modern and efficient equipment and processes are to be adopted.
- FKS can require use of sub-suppliers with purchasing agreements with FKS.

Regarding suppliers of more standardized components, FKS has started implementing simplified procurement processes with. Such suppliers primarily fall in to the “conventional” and to a certain extent towards “associate” level suppliers. However, achieving simplification and reduced spend of resources on these suppliers (with reference to Kraljic’s approach) is seen as a challenge as requirements regarding product documentation (certificates etc.) are extensive and complicated.

To conclude, it is evident that FKS has increased their focus on customer-supplier relationships and the establishment of strategic approaches to the different types of supplier by establishing a strategic procurement department and identifying relevant activities. However, some challenges may arise due to be the fact that distinct strategies have not yet been identified. The following empirical study will investigate and analyze these challenges to establish an understanding of possible root causes, and further suggest suitable counter measures.

6 Empirical Investigation and Analysis

The aim of the empirical investigation was to get information about FKS supplier relationships from several both domestic and international main suppliers of FMC Kongsberg Subsea as well as internal departments as Procurement, QA and Engineering. The following question was to be analyzed: Where do FKS' suppliers and FKS departments see improvement areas FKS' supplier relationships?

The master thesis project was divided into a set of major tasks. This chapter provides a description of these tasks as well as the method used for empirical analysis.

6.1 Background - Documentation of theories

This task concerned searching in relevant literature for relevant theories used as basis for discussing project issues, formulating precise research questions and answering these. The outcome has been presented in chapter 2.

6.2 Background - Introduction to FKS

Introduction was performed during the first weeks at FKS, in order to obtain general information about the company. This included introduction to Intranet, SAP and other systems containing relevant information as well as IT, HSE and Subsea Technology introduction courses.

6.3 Method for Empirical Investigation - Root Cause Analysis

Investigation was performed through a Root Cause Analysis (RCA). A root cause is a specific underlying cause, which reasonably can be identified, and that company management has the control to influence. To prevent recurrence effective solutions must be generated.

6.3.1 RCA as Choice for Empirical Investigation and Analysis

RCA is partially based on Kepner-Tregoe²⁹ (1965), and combined with latest thinking and practical application experience. Basis for RCA is the understanding that treating symptoms and making quick fixes without getting to the root causes of problems and failures leads companies into creating operating, manufacturing, and service environments that “accepts loss” as a normal aspect of operation. This is seen to be a very costly attitude (Kepner and Tregoe 1965). Hence, the objective of RCA is to minimize losses by getting to the root causes of these problems and failures and consequently installing effective permanent solutions and significantly reducing costs. RCA is considered a scientifically valid method for collecting and analyzing empirical data in order to reveal the causes of certain events/phenomena.

²⁹ Kepner-Tregoe was founded in 1958 on the strength of Dr. Benjamin Tregoe’s and Dr. Charles Kepner’s pioneering research in rational problem solving and decision making. The company is headquartered in Princeton, NJ and conducts business in over 50 countries and 20 languages. (www.kepner-tregoe.com)

(Goodacre 2005) Hence, RCA has been considered suitable for the empirical investigation and analysis of this master project.

6.3.2 Research Type

The type of research relevant for this master thesis was *descriptive research*, as descriptive research involves the collection of data in order to test hypotheses or to answer questions concerning the current status of the subjects of the study (here the relationship between FKS and their suppliers). Hypotheses or broad research questions (here as established in “Issues to Be Addressed”) are used (Gay and Airasian 2000).

6.3.3 Interview Guide

Determining the use of either interview guide (with “open” questions) or questionnaire (where possible answers are mainly limited to certain alternatives) depends on how data are intended to be collected. In this master thesis project the collection of qualitative data was mainly done through interviews as written questionnaires are seen to provide poor feedback. Thus, this choice of method for gathering information implied the use of an interview guide. The principles of RCA were used as basis for establishing the interview guide (ref. Attachment #1); identifying, prioritizing and evaluating improvement areas.

6.3.4 Interviews/Data Collection

Interviews were performed based on the established interview guide. FKS employees were asked the question of “Where do you see the top ten weaknesses or improvement areas in the relation between FMC Kongsberg Subsea and your suppliers?” Similarly, suppliers were asked “Where do you see the top ten weaknesses and improvement areas in the relation between your company and FMC Kongsberg Subsea?” Interviewees were thus asked to list top ten improvement areas, and further prioritize by criticality, and evaluate each improvement area for estimated cost for required changes and implementation difficulty.

The importance of not asking leading questions and influencing answers was emphasized. Interviewees were FKS employees and suppliers, selected based on their relevance as interviewees in relation to the task at hand.

Criteria for choice of FKS interviewees were; (1) Having/have had substantial contact with suppliers, and (2) Representatives from Quality Assurance, Product Engineering and

Procurement (Tactical and Strategic) departments, each having different basis for contact with suppliers. In total, 19 FKS employees were interviewed.

Information was further obtained from a wide range of suppliers. Criteria for the selection of suppliers were as follows; (1) suppliers of both standard and specific products and both large and small quantities; (2) both national and international suppliers; (3) the suppliers are active (used in 2005/2006); (4) both SuS and non-SuS suppliers (SuS = Supplier Self Served. These suppliers have access to purchase orders, changes, specifications, requirements etc. through an EDI-system); (5) the suppliers deliver to Kongsberg; (6) suppliers running improvement processes have been avoided as the load on them should not be increased at this time; and (7) suppliers that participated in a similar survey in 2005 have not been considered to avoid “nagging”. In some cases it was not possible to conduct interviews, e.g. with suppliers situated in UK. In these cases, any clarifying questions to received responses (to secure correct interpretation) were communicated through e-mail. In total 6 suppliers were interviewed.

Interviewees will not be identified by name or position as they were guaranteed complete anonymity. This was considered important to secure that responses were not in any way affected by fear of being confronted with this later.

6.3.5 Expected Results

Expected results from performing interviews on FKS-supplier relationships were (1) similar results from the different FKS departments and from suppliers, (2) set of repeatedly named improvement areas, (3) substantial degree of problems introduced by FMC, (4) limited time to complete FKS deliveries as “excuse” for many current problems, and (5) low response percentage from suppliers. The latter was based on the assumption that several suppliers would not give priority to this project as result of having a hectic daily routine, thus it would not be possible to make appointments for interviews.

6.3.6 Validity and Reliability

Analyzing qualitative data has basis in the following two intentions; (1) Thematically organize data; reduce, systematize and arrange collected data to make it analyzable without losing important information; and (2) Analyze and interpret; analyze and develop

interpretations of, and perspectives on, the collected information. (Johannessen, Tufte et al. 2004). This approach was used when working with data gathered through interviews.

A RCA principally requires hard facts to support the collected qualitative data. Difficulties in obtaining such hard facts as well as the time constraint of this project, has made it difficult to support the RCA results with quantitative data. This leads to the question of validity and reliability of the collected data.

In total 19 interviews with FKS employees (internal) and 6 interviews with suppliers (external) were performed for problem identification and description. Regarding requests for interviews in relation to number of interviews held, response rate was 76% (19 responses out of 25 requests) internally, and 32% externally (6 responses out of 19 requests). This is coherent with expected results; assuming a relatively low response rate from suppliers in relation to the response rate of FKS employees (as result of not giving priority to this project). Still, this has been seen not to have considerable impact on the total impression as obtained responses from both external and internal representatives have shown extensive resemblance. Hence, collection of data is considered adequate for its purpose.

In addition, 2 internal (3 to 6 participants) and 2 external (both 8 participants) in-depth brainstorming sessions were performed for determination of possible causes, cause verification and solution development. Concrete examples were provided to support the possible root causes which were identified.

The validity of the collected data is supported by the fact that the interviews and brainstorming sessions were performed with both FKS employees and supplier representatives, thus interviewees were experts facing the relevant challenges in their daily work. Also, criteria for choice of interviewees required suppliers to be active (used in 2005/2006) and FKS personnel to be having/have had substantial contact with suppliers.

As for reliability; qualitative data based primarily on subjective opinions of the interviewees may indicate results that lead to inaccurate conclusions. Thus, it is important to consider the fact that such data are possibly not entirely reliable. Also, in this specific case, interviewees may even have responded in a way they believed FKS wanted them to respond. However, the criteria for choice of interviewees, and the fact that all interviewees were guaranteed complete

anonymity, provides basis for trust in collected data. Further, similar responses have been obtained from both external and internal representatives. Internal representatives from the different FKS departments dealing with suppliers from various angles also report several similar challenges in supplier relationships. Thus, the degree of uniform feedback from participants of both interviews and brainstorming sessions supports the reliability of collected data. Additionally, further discussions with FKS personnel throughout this project lead to the appreciation of collected data as both valid and reliable.

6.3.7 Problem Identification and Description

This first phase of the RCA process is aimed at clearly and rigorously identifying the problem – the difference between the ideal and the actual situation. In the case of this master thesis, the problem was originally identified by FKS and given through the project title and description. The identified need for improvement in SCM with regards to supplier handling implied problems in this area. Further, by performing interviews both internally at FKS and with selected suppliers, the current problems, their origin and related descriptions were identified on a more detailed level.

6.3.8 Ranking, Prioritizing and Summarizing

Issues/improvement proposals were during interviews ranked based on the interviewees'/experts' subjective opinion of the criticality of the particular issue. Further, each issue was evaluated by estimated cost (high/low) and difficulty (easy/hard) of implementing required changes, and ranked based on the principles of a Priority Grid. Figure 6-1 illustrates such a priority grid. Implementation difficulty is presented on the horizontal axis, and estimated implementation costs on the vertical axis. Required change number 7 will most likely be easy to implement at relatively low cost, whereas required change number 1 may be hard to implement and require a substantial degree of funding/investments. As in the case of this master thesis, a priority grid may not be based on scientific facts other than the subjective opinion of the interviewee. Still, the latter is considered a valid method for obtaining such information, especially when a sufficient number of interviewees are asked the same questions.

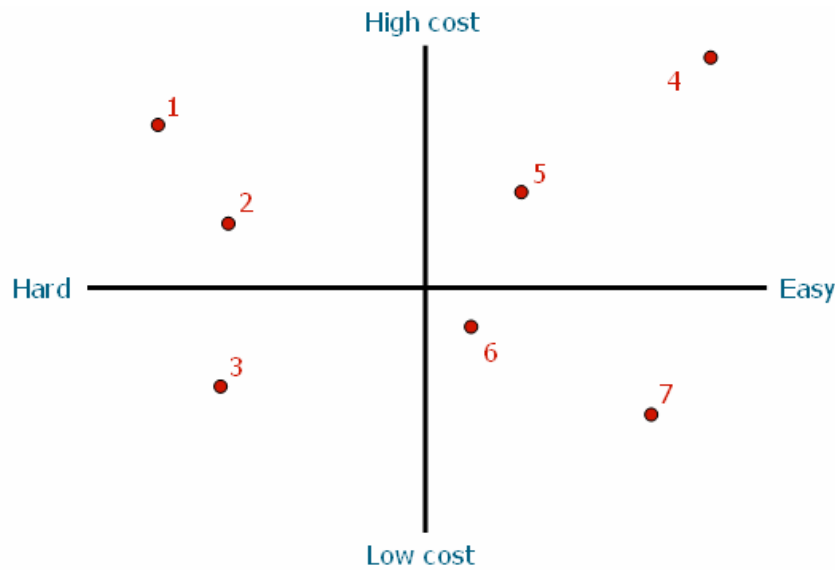


Figure 6-1 Example of Priority Grid
 Source: (Goodacre 2005)

Further, issues/improvement proposals were prioritized by number of times named, estimated implementation cost (low cost – high priority, high cost – low priority), and estimated implementation difficulty (hard – low priority, easy – high priority).

The results were divided into areas, and summarized by FKS departments, FKS total, suppliers, and finally all participants. Top areas were extracted for the following Root Cause Analysis.

6.3.9 Determination of Possible Causes

Possible causes were determined through brainstorming (with both FKS employees and suppliers) and use of Cause and Effect (Fishbone) diagram (Figure 6-2). Cause-effect relationships of major improvement areas were discussed with FKS employees and suppliers showing interest in this master thesis project and the issues to be addressed. With reference to the figure, “Effect/Problem Summary” was the improvement area chosen for discussion, and “Cause Category” the possible causes.

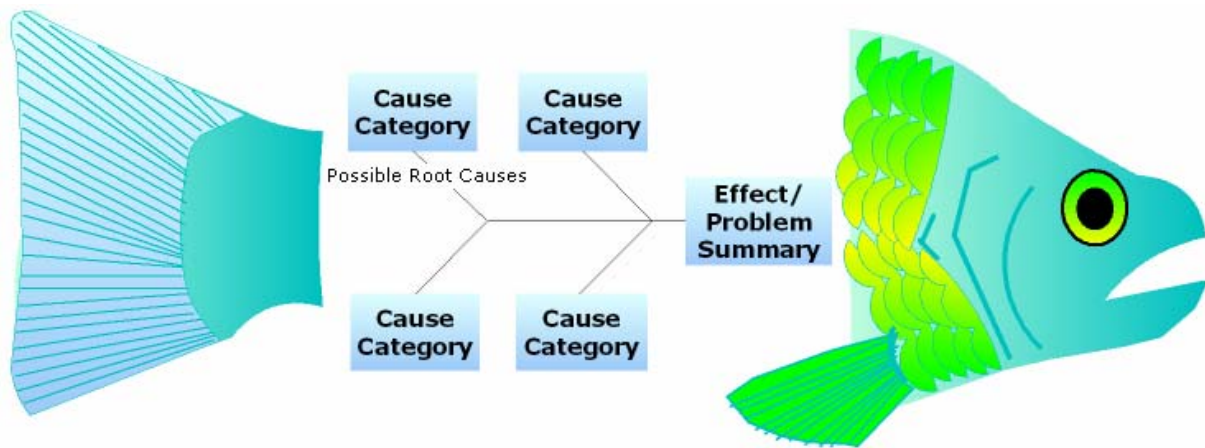


Figure 6-2 Cause and Effect (Fishbone) diagram principle

Groups of FKS employees were composed with the objective to gather a variety of angles for approaching the issues in question. Representatives from QA/HSE, Tactical and Strategic Procurement and Product Engineering departments participated in two sessions. Suppliers participated in a mapping conference with the same objective. Minutes of meeting were written during every session.

6.3.10 Cause Verification (Data Collection)

The objective of this task was to support qualitative and subjective information from the interviews. Cause verification concerned collection of data, facts and evidences through the brainstorming sessions described above, to verify the validity of the most probable cause(s). Experts (selected FKS employees and supplier representatives) were used for verification of causes as not all information can be taken from internal databases and SAP system.

6.3.11 Solution Development

Possible actions for some top improvement areas were also found through the brainstorming sessions with FKS employees and suppliers. Literature and theories presented in chapter 2 and 3 were used to support improvement proposals from brainstorming sessions, and as basis for suggesting solutions suitable for FMC. Additionally, input has been obtained from other companies such as Kongsberg Automotive.

6.3.12 Comparative Analysis

A comparative analysis was performed with Kongsberg Automotive (KA) in order to investigate whether other companies experience the same challenges in their relationships with their suppliers. And if so, it was considered interesting to see if they have already

developed solutions that may be suitable also for FKS. The reason for the choice of a company in the automotive industry was the understanding of this industry as one of the leading in relation to supply chain-focused manufacturing philosophies, such as “lean manufacturing”.

KA’s representative, interviewee Simen Skiaker, works in the supplier quality assurance and purchasing department in Kongsberg Automotive in Hvittingfoss, Norway. He was asked to respond to the same question as FKS interviewees; “Where do you see the top ten weaknesses or improvement areas in the relation between your company and your suppliers?”, now in relation to KA and their suppliers.

Results from the investigation at FKS were compared to Skiaker’s response. The identified similarities and differences, as well as proposed solutions, are presented and discussed in chapter 9.

7 Results of RCA

This chapter will present the results of the performed RCA. Further, the results will be discussed in connection with the theoretical basis provided in chapters 2 and 3.

7.1 Problem Identification and Description

In total, 61 issues/improvement proposals regarding FKS’ supplier relationships were determined through interviewing 19 internal employees and 6 suppliers. Collected data were summarized and organized; (1) systematized by themes, (2) compressed to 22 main areas, and (3) arranged by priority/ranking as described in 6.3.8 (ref. Attachment #2).

7.1.1 Identified Improvement Areas

The 22 main areas that were identified through the empirical investigation and analysis included several different aspects of the relationships between FKS and their suppliers (ref. Attachment #2):

Documentation Training Cooperation Forecast OTD Strategy Communication Processes Sub-suppliers Progress reporting Deviations Products Inventory Testing Prices Feedback Quality Time Costs Distance Continual Improvement Problem solving

Table 7-1 The 22 main improvement areas

In addition to aspects such as *Documentation*, *Training*, *Cooperation* and *Strategy* (described in detail below) challenges related to *Deviations* (deviation registration and handling), *Quality* (suppliers lacking implemented ISO-system and the need for more systematic quality assurance of processes/instructions towards suppliers) and *Problem solving* on a more proactive level were considered important. The challenges can be seen in connection with improvement area *Continual Improvement*, emphasizing the need for more improvement processes, both internally and towards suppliers

Costs imply increased focus on cost efficiency (regarding TCO, logistics etc.). *Prices* concerns spending time to secure good prices/ensure price reduction as result of cost reduction (in relation to improved production processes).

Time is related to the time pressure in the market. Limited time to complete deliveries is considered the reason for many of the current challenges. *Distance* concerns the geographical distance to suppliers. Long distances often make it difficult to visit supplier locations on a frequent basis when this is needed.

Feedback (late feedback on revisions/clarifications) implies need for quicker internal (FMC) task execution. *Inventory* is related to seeking to optimize inventory through a stocking program. Improvement area *Testing* concerns the need for earlier planning of and increased consistency in performing *in-house* and *factory acceptance* tests.

Improvement area *Products* is related to standardization of products, and making products more production-“friendly”. This will be further discussed in relation to requirements regarding product documentation as well as cooperation with supplier, the latter related to strategy.

From the 22 main areas identified through the empirical study and analysis, top ten improvement areas in were extracted for a more detailed description. As described before, the ranking was determined by how many times areas were named, perceived criticality, and estimated implementation cost and difficulty of required changes. Results are listed in Table 7-2:

Ranking	Area	Action required by
1	Documentation	FKS
2	Training	FKS
3	Cooperation	FKS
4	Forecast	FKS
5	On Time Delivery	FKS and supplier
6	Strategy	FKS
7	Communication	FKS
8	Processes	FKS
9	Sub-suppliers	FKS
10	Progress reporting	Supplier

Table 7-2 Top 10 improvement areas ranked and summarized

7.1.1.1 Documentation – Requirements and Expectations

Today’s extensive requirements regarding product documentation are considered one of the most important improvement areas, as both FKS employees and suppliers find it difficult to handle. Purchase orders and specifications from FKS are often incomplete or issued too late, making it difficult for suppliers to deliver on time. Large numbers of changes and corrections are made, purchase orders are not adequately updated, and feedback on clarifications is often late. This is not only a FKS challenge; documentation from suppliers is often also considered late and/or incomplete. In this regard, the need for more adequate contracts describing requirements and expectations, and improved contact review, becomes evident.

Challenges regarding documentation are also closely tied to lack of competence. As expressed before; people cannot deal with things they have no or insufficient knowledge of. The majority of interviewees emphasized the need for improved training, both of suppliers and FKS personnel, e.g. on how to handle documentation-related requirements.

7.1.1.2 Training and Education

Training is thus not only related to documentation, specifications and requirements, but also processes, tools, systems, technology and products. The importance of training is, as stated before, supported by supply chain professionals, arguing that education and training is the basis for supply chain improvement. The ability to follow identified processes and formal working methods requires thorough process knowledge. Education regarding organizational structure and authority has been suggested as contribution to reduce confusion on roles and responsibility. The ability to utilize developed tools and implemented systems requires knowledge of purpose and area of application. Further, establishing an understanding of the technology and construction of products is vital to comprehend supply chain-oriented flows, and align accordingly. This is relevant both for FKS (e.g. engineers designing products), and suppliers manufacturing products that are parts of larger assemblies. Interviewees also emphasize the importance of making products more production-“friendly”.

7.1.1.3 Cooperation

Representatives from FKS and suppliers consider closer cooperation and improved communication as improvement areas. Cooperation in this sense is mainly related to more long-time commitment and agreements with key suppliers, as well as increased cooperation with and follow-up of suppliers both before and during project execution. Increased use of supplier expertise (e.g. on technical clarifications) by suppliers’ participation in design reviews etc. is perceived beneficial for FKS in seeking to optimize products in a supply chain-oriented perspective.

7.1.1.4 Forecast and Predictability

Suppliers emphasize both through interviews and brainstorming sessions lack of demand forecast in general, leading to lack of predictability, as a high priority improvement area. Further, from a supplier point of view, lack of predictability is also closely related to lack of consistent strategies. Investing in FKS-specific equipment is considered high-risk without agreements or even indications of future demand.

7.1.1.5 On Time Delivery

In the view of several interviewees increased focus on On Time Delivery (OTD) is the way to achieve improved delivery precision. In relation to this, substantial time pressure in completing deliveries and lack of sufficient resources is emphasized as limiting factors. On the other hand, the substantial focus on OTD today was by other interviewees considered the

reason for challenges in other areas, such as documentation, which in turn leads to poor delivery precision.

7.1.1.6 Strategy

To what extent a company wishes to cooperate with and commit to their suppliers is a question of strategy. FKS is perceived as being inconsistent on strategies regarding supplier relationships; new managers often imply new strategies. Relationships of the more traditional type, shopping amongst several suppliers of similar products, seem to have been the common strategy for some time. Lately there seems to have been a turn towards more partnership-oriented relationships with selected suppliers. Thus, lack of clearly visible FKS strategy regarding commitment and connections with suppliers is considered a challenge both by suppliers and FKS employees.

Lack of consistent strategies is also related to unclear expectations regarding formal vs. informal communication. According to suppliers FKS require use of formal procedures for communication, and at the same time demand flexibility. Flexibility often includes short-cuts on the outside of formal procedures, often due to time pressure. And when deviations from procedures are recognized, the discussion is who to blame. Hence, it is considered challenging to handle FKS' demand for both formality and flexibility. Suppliers request consistent strategy on use of communication procedures; clarifying expectations and responsibility.

Other aspects related to strategy emphasized through interviews are acquisition of sole and/or single source suppliers and establishment of system suppliers. The argument for acquisition (backwards vertical integration) of sole and single source suppliers is mainly the risk of competitor buy-up or other agreements, but also investing to ensure future capacity. In a theoretical view, this may also be seen in connection with the Principal-Agency theory. Vertical integration of single and sole source suppliers (often holding the power in the relationship) reduces the chances for having to deal with the agency problem, as the flow of information becomes more transparent and results become based on joint effort. Further, building system suppliers is considered a way of reducing total number of suppliers, enabling increased focus and cooperation with a smaller number of key suppliers. The latter is coherent with Kraljic's portfolio approach, as products delivered by system suppliers often are considered of strategic importance due to their complexity.

An FMC engineer emphasized the fact that capacity utilization of some suppliers is close to 100%, and that this is considered critical to capacity. Possibly familiar with this, a purchaser argued that FMC have too few suppliers; critical to both capacity and price competition. This view is understandable as depending on the limited capacity of certain suppliers is considered high-risk. Similarly, having too few suppliers was considered to bring down price and quality competition in the market. However, this view is based on a “shopping”-oriented strategy. Thus, with reference to Kraljic’s purchasing model, increasing the number of suppliers in general may not be an optimal solution to these issues. According to Kraljic it is important to be aware of the distinction between the types of supplier and products, and decide strategies based on this.

Further, commitment from management and throughout the FKS organization in implementing strategies and processes is often considered lacking. This may be related to lack of agreement on the suitability of implemented processes, lack of process knowledge, or possibly resistance to change. As mentioned in the theoretical foundation of this master thesis, powers working against organizational changes are often unfortunate as they can become too strong and damage the opportunities of good and healthy relationships, internally and possibly with suppliers.

7.1.1.7 Communication

Improved communication primarily concerns more consistent use of Single Point of Contact³⁰ towards suppliers, and in general increased use of formal communication procedures. This to secure that people receive all relevant information, that responsibility is clarified, and that especially FKS (also relevant to suppliers) agree internally before addressing suppliers. Today FKS appears not as one, but as several companies, each having different opinions of different aspects. This has not only been reported by suppliers, but also acknowledged by FKS employees. The need for improved internal communication at FKS is also seen through the reported presence of conflicts of interest regarding both technical and commercial aspects. An FKS representative considered extended focus on joint cross-section effort in the acquisition phase as a possible approach to these challenges. Thus, the need for clarification of roles, responsibility and authority, and increased use of formalized communication procedures (both internally and towards suppliers) are considered important improvement areas.

³⁰ Single Point of Contact (SPC) is a person having full responsibility for a certain supplier. This implies that all communication with this supplier in principle should be through the identified SPC. In FKS’ situation, SPC is a purchaser.

7.1.1.8 Processes

Improvement areas regarding processes are mainly related to improved coordination and follow-up. This implies that processes should be coordinated and better aligned to achieve identified targets, including organizing the supply chain in order to reduce problem areas. Today, processes are considered extensive and complicated. This leads to lack of overview, and people are often seen to work within their own “restricted areas”, without sufficient understanding of the process as a whole. Further, interviewees identify the need for increased formal task execution.

7.1.1.9 Sub-suppliers

Further, the handling of sub-suppliers was identified as another improvement area in the relationship with FKS and their suppliers. This is related to the handling of products provided by FKS (Customer Provided Items - CPI)³¹, and is also a question of strategy; whether or not FKS should involve in the choice of sub-suppliers. As of today, identifying and determining use of certain sub-suppliers is a usual routine at FKS. Thus, as sub-suppliers are defined by FKS, suppliers have little influence on the choice of manufacturer, and often feel that they loose control of their own products.

7.1.1.10 Progress reporting

Progress reporting is mainly related to late and/or lacking progress reports from suppliers. This is considered a challenge as it becomes difficult to keep track of the status of a delivery, especially important in case of delays. The result is that FKS employees must spend time and resources to obtain this information themselves.

From these ten improvement areas, four areas were selected for determination of possible causes, cause verification and solution development. The following chapter provides the reasoning for choice of these areas for analysis, and the appurtenant results.

7.2 Determination of Possible Causes/Cause Verification/Solution Development

As introduction to brainstorming sessions (RCA) with FKS employees and suppliers, summarized results from interviews were presented. The participants were given the

³¹ Products manufactured by sub-suppliers on FKS order, and delivered to suppliers for further assembly.

opportunity to choose an area for analysis from the list of top ten improvement areas, and encouraged to choose what they considered most advantageous. The four main improvement areas chosen for the four respective sessions were (1) “Documentation”, (2) “Communication”, (3) “Forecast” and (4) “Sub-suppliers”. (1) and (2) were analyzed internally, and (3) and (4) with suppliers. The reason for the choice of these specific areas was that they were considered the most critical.

Further, the following steps were performed:

1. Cause and effect relationships (possible root causes) were identified through brainstorming and use of fishbone diagram.
2. Possible root causes were during the session systematized and listed for prioritizing.
3. Participants were encouraged to evaluate and rank top three most critical possible root causes. This was done to prioritize and reduce number of root causes to be able to focus on those considered most critical.
4. Thus, top 2-3 possible root causes were selected for solution development. The objective was to obtain suggestions for concrete actions/improvement proposals.

The following chapters presents the results of the investigation and provide a discussion on the three main subjects of this master thesis; the identified improvement areas in FKS supplier handling, the possible root causes and solutions to the identified areas. Possible root causes to identified improvement areas and possible solutions in the form of actions to approach identified challenges in the relationship with FKS and their suppliers were identified through brainstorming sessions with both FMC and supplier representatives. These subjects will be discussed based on interview impressions and own observations, in connection with expected results and the theoretical foundation of this master thesis (chapters 2 and 3).

7.2.1 Improvement Area “Documentation”

The first brainstorming with FKS employees concerned the issue “Documentation” (Table 7-3) (ref. Attachment #3).

Possible Root Cause	Possible solutions
Lack of competence/training	Train employees on products / increase product knowledge Train employees on business processes Train purchasers on E-plan (documentation structure) Use mentors Arrange multidisciplinary training Increase organizational stability
Lack of standarization	Sell FMC standard Visualize profits internally Avoid sub-optimization (through communication) Consolidate development activities Give suppliers own "library" Increase re-use of documentation Select a small number of suppliers for standardization Be consequent on performing Design Reviews

Table 7-3 Top 2 possible root causes and solutions for improvement area "Documentation"

Challenges regarding documentation and appurtenant requirements and expectations were considered primarily rooted in lack of competence and training. This concerns lack of product knowledge, inadequate understanding of established business processes, and in general insufficient training on the extensive set of requirements found in specifications, purchase orders etc. The lack of competence regarding documentation is found both internally and with suppliers. As a result, purchase orders and specifications are issued with errors. Lack of supplier training and instruction on "how to read a FMC purchase order" leads to difficulties, especially when received purchase orders are incorrect.

Another root cause to challenges concerning documentation is lack of product standardization. Lack of standardized products makes FMC unable to standardize specifications and reduce the amount of necessary documentation.

Further, extensive project demands, poor planning and many changes have been proposed as other possible root causes to challenges related to documentation. Projects are often large and complicated, with extensive requirements regarding both design and technical specifications.

Also, quality assurance is often considered inadequate. The oil industry is a rapidly growing industry characterized by substantial time pressure, and lack of resources is considered a challenge in seeking to comply with extensive quality requirements.

Lack of competence and training was considered one of the main possible root causes to challenges regarding documentation. Possible actions to approach this issue are precisely

education and training. Employees should be trained on products to increase product knowledge. This would contribute to the understanding of how different requirements apply to different products, and the importance of being thorough and accurate when working with specifications and purchase orders to secure products without defects and of high quality. Further, training on established business processes is believed to be highly relevant. This is based on the importance of aligning working methods to secure compliance with extensive project demands and documentation requirements.

A possible solution for the reduction of the extensive amounts of required documentation could be increased standardization of products. More standardized products imply more standardized processes, enabling re-use of documentation. As products and processes has been approved, re-approval will not be needed unless changes are made.

An argument against standardization is the fact that FKS produce customer specific products for use in a wide range of operating environments. However, the intention is by far to standardize the majority of products, but by standardizing frequently used components, FKS could enable re-use of documentation. This is also consistent with Kraljic's purchasing model, were the strategic approach to such components is "simplification". Simplification is according to Kraljic achieved precisely through product standardization and more efficient processing.

To succeed with standardization it is considered crucial not only to implement, but to "sell" the FKS standard. Profits of standardization should be visualized internally, giving incentive for the design of more standardized and "supply chain friendly" products. Development activities should be consolidated, and sub-optimization should be avoided. This requires active communication and willingness to cooperate. Further, selling the FKS standard implies consistency towards customers in selling these standardized solutions and visualizing possible cost reductions by use of more standard components.

7.2.2 Improvement Area "Communication"

The second RCA (also though brainstorming with FKS employees) provided the following possible root causes for the subject "Communication" (Table 7-4) (ref. Attachment #5).

Possible Root Cause	Possible solutions
Lack of competence/training	Arrange multidisciplinary courses Extend mandatory training Increase system training - "where do I belong?" Increase use of workshops (department specific) Educate for increased value chain understanding Offer more courses to comply with department needs Offer evening courses with "carrots", i.e. increased responsibility Increase product training - internally and externally Visualize/market courses - urge to participate Establish culture for attending courses "This weeks offer: !!"
Poor EDP* disciplin	Increase training in EDP systems Educate on organizational structure - "Where do I belong?" Establish understanding of consequences Ensure SAP data quality through demands and training Demand consistent use of SAP Introduce blocking - cannot skip / delay step

Table 7-4 Top 2 possible root causes and solutions for improvement area "Communication"

* Electronic Data Processing (computer systems)

Results show that lack of competence and training is again considered one of the main possible root causes to challenges related to communication, both internally and towards suppliers. As employees are not familiar with identified procedures, communication becomes inconsistent. Interviewees emphasize the transition from being project- to process- organized as reason for some of the current challenges.

Experts consider the complex organizational structure of FKS as another possible root cause to inconsistent communication. Roles and responsibility are perceived as being unclear. In large organizations such as FKS, processes are often less visible than in smaller organizations (ref. benchmark with KA). This emphasizes the importance of clarified roles and responsibility, and use of formal communication procedures. Moss Kanter (1994) supports this approach, emphasizing formalized and distinct agreements on responsibility and decision making as success factors in the relationship between companies and their suppliers. Lack of formalized agreements is also considered a possible root cause to challenges regarding communication, as communication both internally and towards suppliers is often too informal, and short-cuts outside of identified procedures are made.

Deviations from formal procedures are also seen through poor EDP-discipline. This is primarily related to the SAP system, as data within this system are, based on interviewees' experience, not considered entirely trustworthy. Inconsistent follow-up and lack of system maintenance, possibly as a result of lack of competence and training, are possible causes for

the reduced quality of these data. Within FKS, SAP was primarily used as a “folder” for data. Today, the use of SAP as tool for analysis, e.g. in relation to supplier performance, has increased. Results of such analyses are used as basis for decision-making e.g. regarding preventive measures in the form of improvement processes. Non-conformance reports are registered in SAP, and affect supplier KPIs (Key Performance Indicators). Further, deviations, among others, are used to identify root causes to problems regarding quality. These root causes, together with other performance measures, are basis for solution development and the establishment of improvement processes. Thus, it is important that measures are based on accurate input data.

Regarding communication between FKS and suppliers, the use of Single Point of Contact is a formally identified process seeking to secure formal communication. Complex organizational structure and unclear roles and responsibility in connection with time pressure in completing deliveries are considered some of the reasons that short-cuts are made. Further, FKS employees point out lack of progress reporting from suppliers, and supplier emphasize poor feedback from FKS. Thus, it is evident that SPC is often not functioning as intended.

Several possible actions to improve communication were suggested. Increased training in business processes, systems and products, both multidisciplinary and department specific, was emphasized. The aim of such training is to increase the understanding of the established processes and procedures in general, and to secure that working and communication patterns are aligned. Further, educating for value chain understanding is aimed at providing insight on the dynamics of the value chain. Ways of achieving this is e.g. by extending mandatory training (introduction courses have already been extended and become more detailed), increasing the use of workshops, and offer more courses, both during day-time but possibly also evening courses. In this regard, it is important to ensure sufficient marketing, and establish a culture for attending courses.

Regarding poor EDP-discipline, training in EDP systems should be increased. It is also considered important to establish an understanding of the consequences of poor data quality in systems such as SAP. Training in addition to consistent demands for the use of SAP may contribute to improved quality of these data.

7.2.3 Improvement Area “Forecast”

The supplier representatives emphasized the importance of predictability in their relationship with FKS. Thus, “Forecast” was considered an interesting subject for analysis (Table 7-5) (ref. Attachment #7).

Possible Root Causes	Possible solutions
Risks and prognosis	Provide prognosis, both binding and not binding Improve communication top - down (FMC) Visualize benefits internally at FMC Establish more consistent strategy (Shopping vs. Partnering) Establish more long term agreements (safer to invest) Arrange periodical meetings on higher organizational level
Relations project / procurement / sales	Move procurement functions to higher organizational level Improve handling of changes / modifications Implement product group procurement Establish more continuous relations between FMC and supplier Establish superior strategy / standardize procedures
Documentation, changes, updating	Improve / increase formal handling of changes / modifications Formal orders / secure SRM* up and running Update documentation, revisions (PO) Secure coherence between SRM and orders Secure more consistent use of SPC* Secure use of defined SRM procedures (Training) Improve communication previous to purchase (FMC)

Table 7-5 Top 3 possible root causes and solutions for improvement area ”Forecast”

* SRM – Supplier Relationship Management (E-business module in SAP).

* SPC – Single Point of Contact, described in footnote 30.

Forecast is related to predictability, and as mentioned before considered an important improvement area in the relationship between FKS and their suppliers, especially from a supplier point of view. Several possible root causes to lack of forecast and predictability were identified through brainstorming with suppliers.

Lack of prognosis in general (project-related) and on a more detailed level (supplier specific) was emphasized as one of the main possible root causes to lack of predictability. This is related to both binding and non-binding prognosis, as both types seem to be lacking. FKS seems reluctant to provide binding prognosis, possible as binding prognosis imply bearing the risk of uncertain demand. Supplier representatives are naturally familiar with this view, but they consider any kind of prognosis, either binding or non-binding, better than no prognosis.

Further, relationships between projects, procurement and sales departments within the FKS organization are considered to be influenced by a culture and attitude of keeping information

within department borders. This is often seen to result in late recognition of demand and consequently late issue of purchase orders to suppliers.

Lack of standardized products is also considered a possible root cause to lack of predictability. If products were more standardized, it would be considered less high-risk to manufacture for stocking, as future demand would enable use of these products. Today, lack standardization, many changes and inconsistent updating of purchase orders are considered to negatively affect predictability.

Finally, suppliers regard lack of long-term agreements as an important reason for lack of predictability. In this regard, long-time agreements are considered to give increased overview, commitment and improved communication, thus increased predictability.

Challenges regarding forecast and predictability may be addressed through several approaches. Establishing more consistent strategies (“shopping”- vs. partnering-oriented) and more long term and continuous agreements with relevant suppliers (with reference to Karljic’s portfolio approach) may lead to increased predictability, especially from a supplier point of view. Also, the benefits of improved forecast and prognosis (such as the possibility for reduced lead times) should be visualized internally at FKS. Improved communication from top management, down through the FKS organization and further out to suppliers (on new projects etc.), possibly through periodical meetings on higher organizational level, may contribute to this.

A possible approach to challenges in the relationships between projects, procurement and sales departments within the FKS organization is to move the procurement function to a higher organizational level. Another suggestion is to implement product group procurement. Both approaches would possibly enable improved coordination of demands, thus provide supplier with more joint prognosis. In any case, superior strategies and standardized procedures regardless of department borders should be established.

Further, the handling of changes and modifications should be improved to secure updated specifications and purchase orders. Communication previous to purchase should be improved (e.g. to clarify requirements perceived as unclear), and the use of SPC should be more

consistent, the latter to secure that formal communication procedures are followed, leaving no doubt of responsibility and authority (coherent with Kanter’s success criteria).

7.2.4 Improvement Area “Sub-suppliers”

The handling of sub-suppliers and customer (FMC) provided items (CPI) was considered another important issue for discussion by the supplier representatives (Table 7-6) (ref. Attachment #9).

Possible Root Causes	Possible solutions
Unclear responsibility	Establish distinct agreements regarding: <ul style="list-style-type: none"> - FMC's supplier expectations - responsibility / delegation of authority - formal or informal communication - rooted in top management (Tore Halvorsen!) Clarify ownership
Network	"Suppliers Day" <ul style="list-style-type: none"> - Include suppliers in planning - dialog / two-way discussion - First day information from FMC - Second day discussion (FMC-supplier and supplier-supplier) - Divide suppliers into groups and perform i.e. RCA Establish web-site for supplier network <ul style="list-style-type: none"> - forum for discussion - FMC provide QSL - Provide general forecast Arrange theme meetings quarterly (non-top-management) <ul style="list-style-type: none"> - project as basis Cooperate regarding discount agreements
Customer (FMC) defined sub-suppliers	Reduce number of Free Issue Items (CPI) Reduce number of customer defined sub-suppliers Communicate <ul style="list-style-type: none"> - reason for use of CPI - allow discussion / input from supplier

Table 7-6 Top 3 possible root causes and solutions for improvement area “Sub-suppliers”

Lacking or unclear agreements on sub-supplier follow-up is considered one of the top possible root causes to the current challenges in the handling of sub-suppliers. Unclear agreements raises the question of responsibility; whether it is FKS’ or the supplier’s responsibility to secure the quality of sub-suppliers’ products and processes. As distinct agreements on responsibility and authority regarding sub-suppliers are lacking, suppliers often feel that FKS are absent, and follow-up of sub-suppliers is left to them.

Further, FKS – supplier – sub-supplier networks are considered not being adequately visible, and coordination between these participants is perceived as being insufficient. Consequently, flow of information and documentation is considered complicated and untidy.

Suppliers propose the establishment of distinct agreements regarding sub-supplier handling as a possible solution to these challenges. Again, this is coherent with Moss Kanter's (1994) argumentation regarding formalized and distinct agreements on responsibility and decision making as success factors. Agreements should thus include clarification of responsibility and delegation of authority. This is related to ownership; who are to be responsible for and in control of products until delivered to FKS. Further, FKS' expectations towards suppliers regarding sub-supplier follow-up should be determined and formal communication procedures should be identified to secure consistency. Suppliers request that such agreements should be rooted in FKS' top management, thus implemented as a consistent routine.

Further, FKS – supplier – sub-supplier networks should be made more visible. This is coherent with the Network Based theory perspective. Arranging “Suppliers Day” is considered a way to achieve this. “Supplier Day” has been held before, and it was considered both successful and useful. However, a few changes were suggested; to include suppliers in planning (to secure that all parties' interests are accounted for) and focus on two-way communication (possibly first day info from FKS, and second day discussions between FKS, suppliers and sub-suppliers).

Another approach to make FKS – supplier – sub-supplier networks more visible is by establishing a web-based network of suppliers. This could be a forum for discussion, and FKS could provide information and general forecast (with reference to Toyota Supplier Support Center, www.tssc.com).

Challenges regarding sub-suppliers defined by FKS can be approach by reducing the number of Customer Provided Items (CPI), and thus the number of FKS defined sub-suppliers, leaving the full responsibility both for choice of sub-suppliers and the products to the suppliers. If FKS wishes to continue the same routines regarding CPI as today, the reasons for this should be clearly communicated to suppliers, and input from and discussion with suppliers should be allowed.

8 Theoretical Contributions to Improved Supply Chain Management at FKS

Through this master thesis it has been documented that interviewees consider the majority of improvement areas in the relationship between FKS and their suppliers to have roots in problems introduced by FKS. There is a wide range of subjects, from “Communication” and “Strategy”, to “Documentation” and “Products” (ref. Attachment #2). Several of these areas are seen to be connected, e.g. as FMC strategy regarding processes, roles and responsibility is perceived as being unclear, communication both internally and with suppliers becomes informal and inconsistent. Areas such as “Documentation” and “Products” are also related; lack of standardized products makes FMC unable to standardize specifications and reduce the amount of necessary documentation.

Determining to what extent companies wish to cooperate with their suppliers is closely related to strategy. In FKS’ situation, committing to long-time partnerships with key suppliers (suppliers delivering strategic and bottleneck products, with reference to Kraljic’s purchasing model) has, among others, the objective of securing future capacity. To make suppliers willing to invest in certain equipment and/or systems, agreements on future cooperation must be established. For suppliers it is considered important to secure risk reduction on financial outlays through increased predictability.

Further, good quality and design on products is seen to be a crucial competitive parameter. Implementing “supply chain thinking” is considered vital in achieving this goal. Developing “fancy” solutions without considering the fact that the component is a part of an assembled product can be destructive to the final result. Thus, increasing the use of supplier expertise on technical clarifications in the design phase can contribute to the development of “supply chain friendly” solutions. This can be seen in relation to Moss Kanter’s (1994) success criteria, emphasizing the importance of openness in exchanging information and the effort of supporting each other being present.

Working together to create “supply chain friendly” solutions requires internal and external willingness to cooperate and actively share information. Hence, based on arguments from the theoretical foundation on supply chain relationships, a more partnership-oriented relationship is considered suitable. As this is considered a “win-win” situation for both parties, the fear of

opportunistic behavior (ref. P-A theory) is avoided. Also, supported by the Network Based Theory perspective; competitive advantage is seen to be achieved through embedded ties.

The theoretical approaches to supply chain management and supply chain participants' behavior provided in this master thesis may thus contribute to the improvement FKS' supplier handling. This is primarily related to the development of strategies regarding organization of the supply base (determining market- or network-oriented approaches), and how to protect relationships with suppliers through the establishment of contracts.

9 Comparative Analysis with Kongsberg Automotive

The target of this comparative analysis was to see whether other companies face similar challenges as FKS in their relationships with suppliers. If so, have they found solutions to these challenges useful to FKS and vice versa? Results from the investigation at FKS were compared to information acquired through interviewing a representative from Kongsberg Automotive in Norway.

Kongsberg Automotive (KA) develops, manufactures and markets systems for gearshift, clutch actuation, seat comfort, stabilising rods, couplings and components. Leading customers include Iveco, DaimlerChrysler, BMW, Ford, Opel, Peugeot/Citröen, Renault, Saab, Scania, Toyota and Volvo. The Group has almost 2,700 employees and annual sales of approximately 340 million US-\$. Headquarter is in Kongsberg, Norway. Manufacturing takes place in Norway, Sweden, England, Poland, USA, Mexico, Brazil, Korea and China. Kongsberg Automotive also has sales and R&D (Research and Development) centres in Germany and the United States, and sales offices in France and Japan. (www.kongsbergautomotive.com)

Interviewee Simen Skiaker works in the supplier quality assurance and purchasing department in Kongsberg Automotive in Hvittingfoss, Norway.

KA Norway has 9 purchasers divided into product groups, responsible for about 160 qualified suppliers. Purchasers are also closely involved in development projects, and they consider it important to thoroughly discuss issues internally before addressing supplier, enabling uniform feedback. This approach is not determined by formal procedures, but the process is more

visible throughout the organization. The latter is possibly a question of the company size, smaller organizations are often more transparent.

According to Skiaker improvement areas in KA's supplier handling are primarily related to improved documentation handling and improved feedback to suppliers on delivery precision and quality, the latter giving incentive for increased focus on delivery precision and quality.

Regarding documentation handling, Skiaker emphasized the importance of securing the quality of technical drawings, specifications etc. before it is sent to suppliers. He argued that the procurement department should be consistent in reviewing such documents and correcting them if errors are detected. This can be seen in relation to FKS, where inconsistent updating of purchase orders (including technical drawings and specifications) is considered a challenge. Further, Skiaker considered sufficient communication during the acquisition phase as important to ensure that all relevant information reaches the respective recipients. This enables discussions between the customer and supplier e.g. on technical design to make products more production- and supply chain- "friendly".

Like FKS, KA experience challenges with incomplete and late documentation from suppliers. About 40% of KA's suppliers are qualified through ISO TS 16949 or QS 9000, meaning that they are familiar with requirements in the automotive industry. The remaining 60% of the supplier base is qualified through ISO 9000, and has less knowledge of such requirements. This is seen to cause reduced ability to comply with requirements, thus KA receives incomplete or wrong documentation on products, certificates etc. Skiaker believed that these challenges could be addressed with increased training of suppliers on specifications and requirements. This is similar to the results of the FKS investigation. For KA, supplier development is formally encouraged through ISO TS 16949.

KA suppliers are evaluated by performance through registration of defect parts received (Parts per Million, PPM). Feedback on performance measures is considered an important improvement area as feedback is essential to make performance evident to suppliers and give incentive for quality improvement. In FKS, feedback related to revisions/clarifications and the need for quicker internal task execution has been identified as an important improvement

area. Thus, improved feedback to suppliers in general is from both KA's and FKS' view considered important in seeking to improve supply chain relationships.

Regarding cooperation with suppliers, KA has organized their suppliers according to Kraljic's purchasing model. Close relationships are established with suppliers delivering strategic and bottleneck products. KA and their suppliers of strategic products cooperate on development, product functionality and price-related issues. Thus, KA actively makes use of supplier expertise. Relationships with suppliers of bottleneck products are based on long-time commitment, emphasizing the importance of securing future capacity. The latter is considered crucial to competitive power. Suppliers of standard products and raw materials are rationalized, meaning reduced time and resources spent on these suppliers.

Handling of sub-suppliers has been identified as an important improvement area within the FKS supply chain. As sub-suppliers are defined by FKS, suppliers feel that they loose control of their own products. In KA's situation, it has not been considered relevant to interfere with their suppliers' choice of sub-suppliers. This is based on the philosophy that suppliers are to have full responsibility for the total product delivered to KA, thus also full responsibility for choice of sub-suppliers. Quality of new products and processes is verified through supplier quality system management (QMS) audit, and it is the suppliers' responsibility that sub-suppliers comply with defined quality requirements. In case of doubt, KA may consider performing QMS audit with sub-suppliers, but this is not considered a standard routine.

Finally, Skiaker emphasized the importance of understanding supply chain dynamics when seeking to improve of customer-supplier relationships. In this regard, education and training of employees and suppliers on the company's organizational structure, processes etc., is considered important. Further, supply chain understanding is crucial to the development of supply chain "friendly" products and solutions. This has also been identified as an important improvement area within FKS. Skiaker suggested arranging a course, primarily for FKS Engineering department, on "Design for Manufacturing and Assembly". Bringing in relevant suppliers, working with such challenges on a daily basis, to educate engineers how to design for more efficient manufacturing (choice of materials, processes etc.) and simplified assembly, with possibilities, restrictions and smart tricks, has been considered beneficial to KA, thus may also be beneficial to FKS.

To conclude, it is evident that KA as a serial production-oriented company in the automotive industry and FKS as manufacturer of more customer tailored products of considerably smaller numbers, face some similar challenges in relationships with suppliers. This is mainly related to documentation handling and feedback to suppliers. It seems that KA as a smaller organization eludes some challenges more prominent in larger organizations such as FKS, as procedures are more visible. Also, with reference to Toyota and other large automotive manufacturers, it seems that the automotive industry has come further in the focus on supply chains and lean thinking, emphasizing the importance of eliminating waste and making supply chains more efficient. This may be the result of the automotive industry being even more competitive than the oil industry is seen to be, with constant demands for price reductions etc., as well as the automotive industry being older and thus more “mature”. Still, in finding its way, the automotive industry can provide the oil and subsea industry with companies as FKS with valuable input. Some methods may not be suitable due to different production patterns, but aspects such as increased focus on efficiency and waste elimination are important for competitive power regardless of industry.

10 Way Forward

The development of solutions resulted in about 60 possible actions related to the identified improvement areas. These actions were evaluated in an in-house session at FKS, with selected participants from the earlier interviews and brainstormings. Participants were one from each department, QA, Tactical Procurement, Strategic Procurement and Engineering.

The 60 actions (each related to a specific root cause) were systematized by area and divided into 9 “action groups”. Further, the actions were sorted into four groups, based on an estimation of implementation cost and difficulty:

- Group 1: Easy to implement of low cost
- Group 2: Easy to implement, but high cost
- Group 3: Hard to implement, but low cost
- Group 4: Hard to implement of high cost

In order to establish a proposal for an internal improvement project at FKS, actions in group 1 were considered a suitable starting point. The latter is based on the recognition that starting with the “simple” things first may show relatively quick results and give incentive and a

positive attitude for continuing with more extensive improvements. In this regard it is important to note that more extensive improvements are likely to provide even greater positive results in a long-time perspective.

Through evaluation the group of easy to implement at low cost-actions ended up consisting of the following actions (Table 10-1). This is basis for an action list for an internal improvement project:

Area/Action Group	Related Root Cause	Actions
Internal and external training of personnel	Lack of competence and training related to documentation and communication	<ul style="list-style-type: none"> ▪ Increase internal product training* ▪ Increase internal training on organizational structure, systems and business processes at FKS* ▪ Train purchasers on E-plan ▪ Arrange multidisciplinary training and courses on SCM flow ▪ Educate for increased value chain understanding ▪ Bring in relevant suppliers to arrange a course, primarily for FKS Engineering, on “Design for Manufacturing and Assembly”, to educate engineers how to design for more efficient manufacturing and simplified assembly.
	Poor Electronic Data Processing discipline	<ul style="list-style-type: none"> ▪ Increase internal training on organizational structure, systems and business process at FKS* ▪ Establish understanding of consequences of data failures e.g. in SAP purchase orders and QNs
	Forecast to suppliers	<ul style="list-style-type: none"> ▪ Visualize benefits/profits of forecast internally at FKS
Introduction of new employees	Lack of competence and training related to documentation	<ul style="list-style-type: none"> ▪ More intensified use of mentors
Communication with suppliers	Forecast to suppliers	<ul style="list-style-type: none"> ▪ Arrange periodical meetings between FKS and strategic suppliers on a higher organizational level
Supplier network	Lack of supplier network	<ul style="list-style-type: none"> ▪ “Suppliers Day” <ul style="list-style-type: none"> - Include suppliers in planning - Encourage dialog / two-way communication - Extend “Suppliers Day” with one day; <ul style="list-style-type: none"> First day information from FMC , second day discussion

		<p>(FMC- supplier and supplier-supplier)</p> <ul style="list-style-type: none"> - Divide suppliers into groups (e.g. by products, projects or commodities) to discuss specific subjects <ul style="list-style-type: none"> ▪ Arrange theme meetings quarterly (non-top-management) with project as basis ▪ Cooperate regarding discount agreements ▪ Establish supplier web-site (ref. www.tssc.com)
Communication with suppliers	Forecast to suppliers	<ul style="list-style-type: none"> ▪ Arrange periodical meetings between FKS and strategic suppliers on a higher organizational level
Product and document standardization	Lack of product standardization	<ul style="list-style-type: none"> ▪ Establish FKS “Engineer of the Month” award to give incentive for the development of supply chain “friendly” solutions

Table 10-1 Action list for an internal improvement project at FKS

* Already initiated by FKS e.g. through extended introduction training for new employees.

These results should be seen in connection with other actions already identified and initiated by FKS (e.g. extended and more detailed introduction training for new employees). Thus, an internal improvement project based on these results should be integrated in the improvement processes that are already running.

11 Conclusion

The results of the empirical investigation and analysis of this master thesis show that FKS has potential of substantial cost savings and increased profits by increasing the focus on supply chain management in relation to supplier handling. As about 70% of FKS’ turnover is spend for supplied products and services, and quality, reliability and on-time delivery of supplied products are major influence factors on FKS’ deliveries, it is evident that the success of FKS is highly dependent on the supply chain as a whole.

FKS suppliers are mostly subcontractors manufacturing products and components based on specifications and requirements provided by FKS. Some suppliers deliver standardized components, and some provide FKS with highly tailored products and solutions. This

emphasizes the importance of distinct supplier strategies depending on product type and significance for FKS' deliveries to the final customers.

Communication with suppliers is organized through the Procurement Process, describing how purchases are performed (by the Tactical Procurement department) and how FKS works to develop new and existing supply chains (through activities in the Strategic Procurement department). The Strategic Procurement department also works with strategic approaches to the different types of suppliers. As of today, FKS has not formally classified their suppliers by the principles of Kraljic's portfolio approach, but the criteria that have been identified for determining eventual establishments of frame and partnering agreements are closely related to Kraljic's classification method. In this sense, frame or partnering agreements are or will be established with suppliers of high significance for FKS (in relation to spend, capacity, degree of specialized products etc.) to secure compliance with future demand. Simplified procurement is established with suppliers of more standardized products.

Identified improvement areas in the relationships between FKS and their suppliers are primarily based on the need for increased training of FKS employees and suppliers, clarification of roles and responsibility, establishment and implementation of distinct strategies regarding supplier handling (including closer cooperation with strategic suppliers), and systematic approach to pro-active supplier development. In this regard, this master thesis may contribute to the development of strategies based on theoretical approaches to supply chain management and supply chain participants' behavior. This is related to the organization of the supply base (determining market- or network-oriented approaches), and how to protect relationships with suppliers through the establishment of contracts. Further, the proposed solutions and actions are aimed at directly addressing the current challenges in the relationships between FKS and their suppliers.

This master thesis finally concludes by emphasizing three areas of interest considered to have highly positive effects on the relationships between FKS and their suppliers, and in a long-term perspective contribute to increased profits and market shares:

- Identify and communicate internally and externally (to FKS, suppliers and customers) clear strategies regarding cooperation and commitment, and responsibility and authority, in relation to suppliers. Make it clear for all involved parties that these strategies are rooted in top management and apply to the entire organization.

- Train employees and suppliers on products and business processes to ensure that everyone is working in the same direction to make the most of potentials.
- Increase cooperation and communication with strategic suppliers ahead of purchase to enable development of supply chain “friendly” solutions and reduction of changes and alterations. Do things “Right the First Time”!

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13 Attachment List

Attachment #1 – Interview Guide

Attachment #2 – Interview Results Full List

Attachment #3 – Fishbone Improvement Area “Documentation”

Attachment #4 – RCA Results Improvement Area “Documentation”

Attachment #5 – Fishbone Improvement Area “Communication”

Attachment #6 – RCA Results Improvement Area “Communication”

Attachment #7 – Fishbone Improvement Area “Forecast”

Attachment #8 – RCA Results Improvement Area “Forecast”

Attachment #9 – Fishbone Improvement Area “Sub-Suppliers”

Attachment #10 – RCA Results Improvement Area “Sub-Suppliers”

Attachment #11 – Evaluation of Possible Solutions

