

LJUBLJANA UNIVERSITY
FACULTY OF ECONOMICS

MASTER'S DEGREE THESIS

Management of the Supply Chain –
Case of Danfoss District Heating Business Area

Ljubljana, February 2006

EVA KLEMENČIČ

Author's STATEMENT

I **Eva Klemenčič** hereby certify to be the author of this Master's thesis that was written under the mentorship of Prof. Rudi Rozman and in compliance with the Act of Authors' and Related Rights – Para. 1, Article 21. I herewith agree this thesis to be published on the website pages of the Faculty of Economics.

Ljubljana, date.....

Signature:.....

LIST OF CONTENTS

	Page
1. INTRODUCTION	1
1.1. PROBLEM	1
1.2. PURPOSE AND GOALS OF THE THESIS	3
1.3. METHOD OF THE THESIS	4
1.4. STRUCTURE OF THE THESIS	5
2. WHAT IS SUPPLY CHAIN MANAGEMENT	6
2.1. DEFINITION OF SUPPLY CHAIN	6
2.2. DEFINITION OF MANAGEMENT	8
2.3. DEFINITION OF SUPPLY CHAIN MANAGEMENT	12
2.3.1. Supply Chain Management as a Management Philosophy	13
2.3.2. Supply Chain Management as a Set of Activities to Implement a Management Philosophy	13
2.3.3. Supply Chain Management as a Set of Management Processes	14
2.3.4. Supply Chain Management versus Supply Chain Orientation	17
2.3.5. Supply Chain Management versus Logistic	18
2.4. DRIVERS OF SUPPLY CHAIN DEVELOPMENT AND MAIN INITIATIVES	20
2.5. DIFFERENT INITIATIVES AND LEVELS OF SUPPLY CHAIN MATURITY	22
2.6. LEVELS OF SUPPLY CHAIN MATURITY AND BUSINESS RESULT	24
3. KEY COMPONENTS OF SUCCESSFUL SUPPLY CHAIN MANAGEMENT	25
3.1. SUPPLY CHAIN AS A STRATEGIC ASSET	26
3.1.1. Supply Chain Strategy Building Blocks	27
3.1.2. Key Criteria for a Good Strategy	28
3.2. KEY SUPPLY CHAIN PROCESSES	31
3.3. DESIGN OF SUPPLY CHAIN ORGANISATION	33
3.4. DEVELOPMENT OF A COLLABORATIVE MODEL	35
3.4.1. Definition of Collaboration	35
3.4.2. Key Areas with Increasing Need for Collaboration	37
3.5. DESIGN OF MEASUREMENT SYSTEMS AND MEASUREMENTS	38
3.6. MOST COMMON BENEFITS, BARRIERS AND BRIDGES TO SUCCESSFUL SUPPLY CHAIN MANAGEMENT	42
4. INTRODUCTION OF DANFOSS DISTRICT HEATING BUSINESS AREA	44
4.1. INTRODUCTION OF DANFOSS GROUP	44
4.2. INTRODUCTION OF DISTRICT HEATING BUSINESS AREA	45
4.2.1. DHBA Business Development	45
4.2.2. Products and Markets	47
4.2.3. Organization	49
4.2.4. Vision	51
4.3. DH SUPPLY CHAIN AND SCOPE OF FURTHER ANALYSIS	52

5. ANALYSIS OF DANFOSS DHBA SUPPLY CHAIN MANAGEMENT	53
5.1. WHY DHBA IS FOCUSING ON SUPPLY CHAIN MANAGEMENT	53
5.2. DH SUPPLY CHAIN VISION AND STRATEGIES	54
5.2.1. Customer Service Strategy	55
5.2.2. Manufacturing Strategy	57
5.2.3. Outsourcing Strategy	59
5.2.4. Purchasing Strategy	60
5.2.5. Infrastructure	61
5.3. PROCESSES AND COLLABORATION MODEL	63
5.4. MANAGEMENT AND ORGANISATION	65
5.5. BALANCED METRICS	71
5.6. DHBA SUPPLY CHAIN STRATEGY IMPLEMENTATION	72
5.6.1. Plateau B: Integrated Supply Chain	73
5.6.2. Plateau C: Merge with Danfoss IWK Supply Chain	74
5.6.3. Plateau D: Euro-land / Synchronized Supply Chain	75
6. ANALYSIS OF CURRENT PERFORMANCE	76
6.1. TIME PERSPECTIVE	76
6.2. COST PERSPECTIVE	77
6.3. SERVICE PERSPECTIVE	79
6.4. QUALITY PERSPECTIVE	80
6.5. BENCHMARKING SUPPLY CHAIN PERFORMANCE	82
7. STRENGTHS AND WEAKNESSES OF CURRENT SUPPLY CHAIN MANAGEMENT AND INITIATIVES FOR THE FUTURE	83
7.1. STRATEGIC ORIENTATION	84
7.2. PROCESSES AND IT SUPPORT	86
7.3. MANAGEMENT AND ORGANISATION	87
7.4. COLLABORATION MODEL	88
7.5. MEASUREMENT SYSTEM	89
7.6. KEY INITIATIVES FOR THE FUTURE	91
8. CONCLUSION	93
LITERATURE	97
SOURCES	99
APPENDIX	i
POVZETEK	

LIST OF TABLES

	Page
Table 2-1: Relations between Management, Business, and Organizational Processes	9
Table 2-2: Management Processes, Purpose, Tasks, and Skills	10
Table 2-3: Distinct Management Processes	16
Table 2-4: Comparison of Supply Chain Management Frameworks (GSCF, SCOR)	16
Table 3-1: Supply Chain Contribution to Business Strategy	29
Table 5-1: Customer Offerings	56
Table 7-1: Strengths and Weaknesses of DHBA Supply Chain Strategy Main Building Blocks	84
Table 7-2: Strengths and Weaknesses of DHBA Supply Chain Strategy by Main Criteria's	85
Table 7-3: Strengths and Weaknesses per Key Processes in DHBA Supply Chain	86
Table 7-4: Strengths and Weaknesses: Management and Organization	87
Table 7-5: Strengths and Weaknesses by Areas: Between Processes within Operations, with Other Functions, with Internal/External Suppliers, Customers and Other Partners	88
Table 7-6: Strengths and Weaknesses of Measurement System	90
Table 7-7: Key Focus Areas for the Future Supply Chain Improvements	92

LIST OF FIGURES

	Page
Figure 2-1: Competitive Framework in the Supply Chain	7
Figure 2-2: Supply Chain or Supply Chain Network	8
Figure 2-3: Supply Chain Management Reasons and Consequences	17
Figure 2-4: Perspectives of SCM versus Logistic	18
Figure 2-5: Generic Value Chain	19
Figure 2-6: The Value System	20
Figure 2-7: A Decade of Supply Chain Initiatives	21
Figure 2-8: Levels of Supply Chain Maturity	23
Figure 3-1: Five Core Disciplines for Strategic Supply Chain Management	26
Figure 3-2: Types of Manufacturing Strategy	27
Figure 3-3: Market Winners – Market Qualifiers Matrix for Agile versus Lean Supply Chain	29
Figure 3-4: Matching Supply Chain with Products	30
Figure 3-5: Supply Chain Practices and Basis of Competition	32
Figure 3-6: New Roles for End-to-End Supply Chain Management	35
Figure 3-7: Supply Chain Collaboration Areas with Highest Potential	37
Figure 3-8: Biggest Problems in Supply Chain that Impact Shareholder Value	38
Figure 3-9: Supply Chain Metrics	39
Figure 3-10: From Supply Chain Decision through Capabilities to Financial Results	40
Figure 3-11: Definition of EVA, RONA	41
Figure 3-12: Top Ten Benefits, Barriers, and Bridges to Supply Chain Management	43
Figure 4-1: Danfoss Divisions	45
Figure 4-2: DHBA Turnover Growth in Million DKK	46
Figure 4-3: DHBA Main Milestones	46
Figure 4-4: Two Main Types of Product Offerings	47
Figure 4-5: Share of Turnover per Product Types in 2004	47
Figure 4-6: Main Product Applications	48
Figure 4-7: Share of Turnover per Customer Type in 2004	48
Figure 4-8: Share of Turnover per Regions	49
Figure 4-9: Organization of DHBA	49
Figure 4-10: DH Operations Organization in 2005	50
Figure 4-11: Level of Integration in DH Supply Chain	52
Figure 5-1: Concept of Order and Customer Relations' Management	56
Figure 5-2: Make to Order Manufacturing Strategy	57
Figure 5-3: Manufacturing Concept of Decoupling Points	58
Figure 5-4: Daily Planning Concept	58
Figure 5-5: XYZ Concept for Daily Balancing of Capacities	59
Figure 5-6: Outsourcing Concept	60
Figure 5-7: Portfolio Matrix of Suppliers and Materials	61

Figure 5-8: Integrated Supply Chain Model: Process and Collaboration Aspect	64
Figure 5-9: Core DH Supply Chain Processes Divided in Sub-Processes	65
Figure 5-10: Management and Organization Model	66
Figure 5-11: Total Order Management Concept	67
Figure 5-12: Supply Chain Planning Concept – Different Levels of Planning	67
Figure 5-13: Supply Chain Planning in Time Perspective	68
Figure 5-14: Concept of Availability Management	69
Figure 5-15: Balanced Scorecard	71
Figure 5-16: DHBA Supply Chain Vision and Development Path	72
Figure 5-17: Objectives of Plateau B	74
Figure 6-1: Logistic Costs as Percentage of Turnover (Total Net Sales)	77
Figure 6-2: Stock Costs as Percentage of Turnover (Total Net Sales)	78
Figure 6-3: Service Level Measurements: Availability and Reliability for CDC from 2000 to 2005	79
Figure 6-4: Service Level Measurement from Production (SIDH) to CDC and from Suppliers to SIDH	80
Figure 6-5: Benchmarking DHBA Supply Chain Performance	82
Figure 6-6: Maturity Level of Supply Chain Processes	83
Figure A-1: Types of Products	i
Figure A-2: Physically Efficient versus Market Responsive Supply Chain	i
Figure A-3: Example of RACI Structure for Procurement	ii
Figure A-4: Objectives per Critical Success Factor for DH Operations	ii

LIST OF ABBREVIATIONS:

APS:	Advanced Planning and Scheduling
BTS:	Built-to-Site
CDC:	Central Distribution Centre
COGS:	Cost of Goods Sold
CPFR:	Collaborative Planning, Forecasting & Replenishment
CRM:	Customer Relations Management
DH:	District Heating
DHBA:	District Heating Business Area
DHW:	District Heating Works
DKDHH:	Danfoss Nordborg Headquarters
DSC:	Danfoss Sales Company
EDI:	Electronic Data Interchange
ERP:	Enterprise Resource Planning
GSCF:	Global Supply Chain Forum
HVAC:	Heating, Ventilation, and Air-Conditioning
IT:	Information Technology
JSA:	Joint Service Agreements
KPI:	Key Performance Indicators
MRP II:	Materials Requirements Planning
OEM:	Original Equipment Manufacturer
PLM:	Product Lifecycle Management
RACI:	Responsible, Accountable, Consulted, and Informed
RONA:	Return on Net Assets
SCOR:	Supply Chain Operation Reference model
SAP:	Enterprise Resource Planning System used in Danfoss
SC:	Supply Chain
SCM:	Supply Chain Management
TNS:	Total Net Sales
TQM:	Total Quality Management
VMI:	Vendor Managed Inventory

1. INTRODUCTION

1.1. PROBLEM

Over the past decade, there has been an increasing emphasis on supply chain management as a vehicle through which firms can achieve competitive advantage in markets (Collin, 2003, p. 8). A large number of examples in the 1990s show how companies have made large investments to streamline their supply chains in order to improve customer satisfaction and increase their internal productivity. As Christopher (1998, p.130) states, it is not actually individual companies that compete with each other nowadays; rather, the competition is between rival supply chains. The supply chains that add the most value for customers with the lowest cost in the chain make up the winning network of individual companies.

As companies are now seeking how to integrate decisions across supply chain functions, across geographically dispersed facilities, and across time, **the facts based supply chain management is crucial**. The essence of fact-based supply chain management is integrated planning and control, which has three important dimensions. The first dimension is functional integration involving decisions about purchasing, manufacturing, and distribution activities within the company and between the company and its suppliers and customers. The second dimension is geographical integration of these functions across physical facilities located on one or several continents. The third dimension is inter-temporal integration of strategic, tactical, and operational supply chain decisions. To put it simply, strategic planning and control are concerned with resource acquisition, while tactical planning and control focus on resource allocation and refinement, and operational planning and control are concerned with business execution (Shapiro, 2001, p. 1).

Therefore, management of supply chains in a business environment has a major financial impact on all parties involved in the chain. Due to that, research and implementation of supply chain management principles to improve the supply chain are of key importance to any global company today.

In the thesis theoretical framework is used to evaluate the supply chain management concepts on part of Danfoss. Danfoss is Denmark's largest industrial group with an annual sales turnover in 2004 of 2,008 million EUR and about 18.000 employees. It is a global company, organized in three business divisions. District Heating Business Area is part of the Heating Division (hereafter DHBA).

DHBA recognized the importance of supply chain already some years ago. In year 2000, DHBA started a strategic project in supply chain area. The purpose of the project was to implement integrated management of the DH supply chain, with the overall objective to increase service level to customers and reduce logistic cost as percentage of turnover. To be able to implement the complex change, required to manage supply chain in coordinated manner, KPMG consulting company was engaged. The implementation started in year 2001.

The first step in the process of change was to define the vision of the DH supply chain, as it should be in few years. **The ultimate vision of DHBA supply chain was defined as a synchronized supply chain.** The objective of which is to coordinate a customer order with production order as well as purchasing order, with less than one week of inventory of finished products. The ultimate goal is to bring the DHBA supply chain up to world-class performance and thus achieve significant competitive advantages. The financial target was a 40% logistic cost reduction from year 2001 to year 2003. To implement the vision, the plateau (milestones) approach was selected, as the complexity of implementation and the related risk was high. Depending on the plateaus, different initiatives were proposed and objectives set.

One of the preconditions for the effective supply chain management was organizational change. To assure that supply chain is managed as one integrated process, logistic processes on different locations were joined into one process named DH Operations.

The main strategies to meet business targets such as reduction of costs and increase of service level were:

- Cycle time reduction from suppliers to production units, from production units to distribution centres and from distribution centres to market.
- Increased flexibility by suppliers and in production.
- Increased reliability between partners in supply chain, to increase trust.
- Integrated planning process, to coordinate efforts across the supply chain.

There were four main enablers of synchronized supply chain:

- IT integration: Advanced planning and scheduling (APS) system, to manage and optimise the supply chain from raw materials through to deliveries.
- Working with world-class suppliers and logistic service providers, and utilizing web ordering, EDI and VMI for integration of all parties in the supply chain.
- Fast distribution and replenishment: 48 hours internal lead-time from customer order receipt through to manufacturing and distribution to regional stock points.
- Consolidation of warehouses in Europe, from which all customers will be supplied.

The problem that I would like to address in this thesis is the following. If we compare the objectives set with the actual achievements today, we can see that **results deviate from targets**.

As DHBA is growing fast, it is difficult to evaluate, what the reasons for such development are. But it is important to know the reasons, so that suggestions for changes can be made. On the other hand, the analysis of the reasons can also contribute as a learning point that the mistakes would not be repeated in the extended part of the supply chain in recent years. The extension of supply chain is a result of DHBA growth strategy as a competitive strategy, which enables growth by acquiring new companies (forward vertical integration), introducing new products, and entering new markets. The scope of DHBA supply chain today includes a network of component and material **suppliers**, located mainly in Europe; **production units** in Slovenia, Germany, Denmark, Finland, Poland, Russia, China; a **distribution centre** in Denmark; **local sales companies** in Europe, Russia, China; including their biggest customers and **OEM customers** mainly in Europe.

1.2. PURPOSE AND GOALS OF THE THESIS

The problem stated above is that current performance of supply chain is not yielding the planned results in terms of total logistic cost and service level in desired time. **The purpose of this thesis is to identify the reasons for such development and to highlight the theoretical frameworks which could improve supply chain performance especially in terms of service level and logistic costs in the future.**

For DHBA, integrated supply chain management is one of the key strategies for improving operational effectiveness. Therefore, the importance of it is actually increasing as the complexity of supply chain in terms of products, markets and members of the chain is growing. This is an additional reason, why it is important to investigate how the performance of the supply chain can be brought to the desired level or to set up achievable targets and realistic expectations.

The ultimate goal of the thesis is to present the management of DHBA with suggestions as to where it is necessary to focus in the future to achieve the desired performance of supply chain and in that way establish a base for making decisions.

The first step in the process of achieving ultimate goal is to find the main reasons for deviations by evaluating current supply chain main areas (according to the model from Cohen) and by evaluating current supply chain performance.

Based on that, the improvement possibilities are grouped in the following focus areas:

- View of supply chain.
- Process infrastructure.
- Organization.
- Collaboration with internal and external partners.
- Measurement system.

The last step in the process of achieving the ultimate goal of this thesis is to evaluate improvements according to the contribution to the desired result.

1.3. METHOD OF THE THESIS

To be able **to reach the ultimate goal**, which is to present the management of DHBA with suggestions as to where it is necessary to focus in the future to achieve desired performance of supply chain in terms of service level and logistic costs, **different methods** are used:

- The first method used is a review of the relevant literature and theoretical findings on supply chain management and supply chain management implementation as well as the most common barriers and bridges that companies are facing when implementing supply chain initiatives.
- This is followed by a review of supply chain implementation practices on the case of DHBA. The review focuses mainly on documentation made during the supply chain implementation projects and other internal documentation available at DHBA.
- The next method used in the thesis, is an evaluation of the current supply chain performance on the basis of existing key performance indicators compared to initial targets and benchmarking of some key performance indicators against best in class companies.
- To be able to identify reasons for such development as seen by owners of different supply chain processes, the method of interviews is used, discussing results achieved in the last few years, identifying the main reasons for deviations and improvement potential in the future.
- Based on the analysis of the theoretical and empirical findings on supply chain management and on the case of DHBA, a synthesis of results is drawn up. The synthesis groups the improvement possibilities in five focus areas: strategic view of supply chain, processes, organization, collaboration, and measurement system.
- To evaluate the improvement potential of the various improvement initiatives, the theoretical evaluations are applied to the case of DHBA.

1.4. STRUCTURE OF THE THESIS

Following the introduction of the problem, purpose, goals and method of the thesis, the chapters are organized in the following way.

The **second chapter** summarizes the most common definitions in the field of supply chain, management in general and further on supply chain management. Then, the reasons why more and more companies are focusing on supply chain management are explained. Further in the chapter the main drivers that have major impact on fast development of supply chain practices and models are mentioned. Continuing, the chapter describes how companies can be grouped in different levels of supply chain maturity (a model developed by Cohen). The maturity levels are defined by how advanced companies are in using different supply chain practices. Wrapping up, the chapter links the level of supply chain maturity to the overall results of the companies.

The **third chapter** describes key components or building blocks needed for successful supply chain management, based on the model, which Cohen has developed over the past years. I have chosen to use this model as it is one of the latest approaches, and it is based on the SCOR process reference model, which DHBA implemented with slight modification in year 2002. The key components defined are: the view of the supply chain as a strategic asset, the design of key business processes, defining an organization that can manage those processes, the design of a collaboration model and the design of a measurement system. The chapter concludes with describing the most common benefits of supply chain management and the most common barriers and bridges of its implementation.

The **fourth chapter** is a general introduction to Danfoss and Danfoss District Heating Business Area as a part of it. Here, also DHBA current supply chain is described, to make a basis for further analysis in the chapters to follow.

The **fifth chapter** analyses supply chain management practices dividing them into building blocks as they are described in the Cohen model. The chapter starts with evaluating supply chain strategies, processes, organization, collaboration model, and concludes with an evaluation of the measurement system. The critical evaluations of the current state are written in italics text at the end of each paragraph.

The **sixth chapter** evaluates the performance of supply chain on the basis of the current performance indicators. They are divided into four critical success areas: time, service, quality, and cost. The chapter ends with a benchmarking of the current performance with industry peers that was conducted in year 2004.

The **seventh chapter** is based on the fifth and sixth chapter as well as interviews with the key process owners summarizing main strengths and weaknesses of the current supply chain. Based on that, also key improvement areas are outlined and evaluated, in terms of their impact on RONA.

2. WHAT IS SUPPLY CHAIN MANAGEMENT

2.1. DEFINITION OF SUPPLY CHAIN

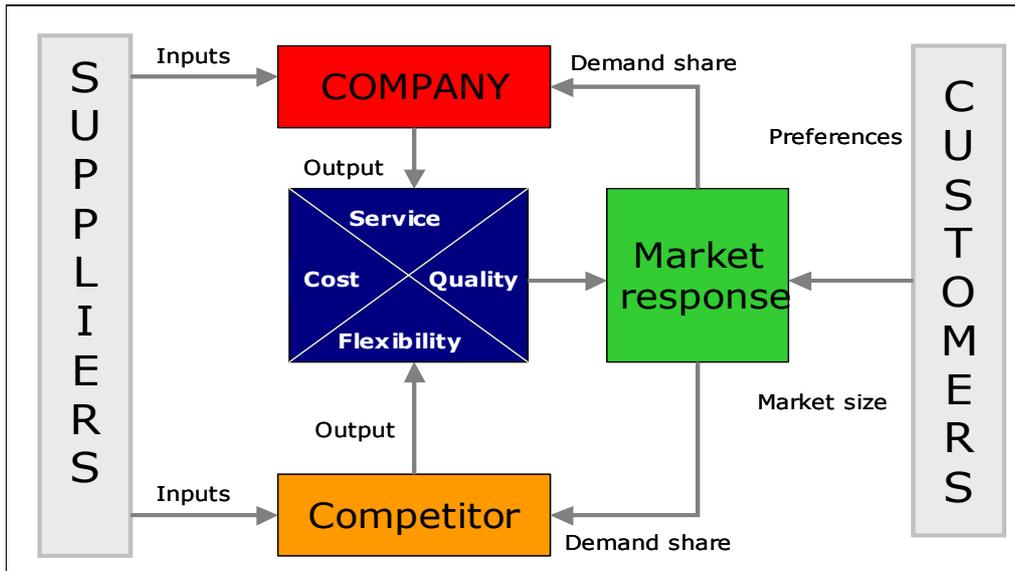
Many organizations today are forced to increase their global market share in order to survive and sustain growth objectives. At the same time, these same organizations must defend their domestic market share from international competitors. The challenge is how to expand the global logistic and distribution network, in order to ship products to customers who demand them in a dynamic and rapidly changing set of channels. Strategic positioning of inventories is essential, so that the products are available when the customer wants them (Handfield, et al. 2002, p. 38).

Domenica (2002, p. 8) also claims that supply chain should actually be efficient and effective. In this case, efficient means to minimize resource use to accomplish specific outcomes; and effective, in terms of designing distribution channels. Efficiency is measured by delivery performance, product quality, backorders and inventory level, whereas effectiveness is measured by service quality and the service needs.

Long-term competitiveness therefore depends on how well the company meets customer preferences in terms of service, cost, quality, and flexibility, by designing the supply chain, which will be more effective and efficient than the competitors'. Optimisation of this equilibrium is a constant challenge for the companies which are part of the supply chain network, shown in Figure 2-1.

To be able to optimise this equilibrium, many strategic decisions must be taken and many activities coordinated. This requires careful management and design of the supply chain. The design of supply chains represents a distinct means by which companies innovate, differentiate, and create value (Longitudes 04, 2004, p. 8). The challenge of supply chain design and management is in the capability to design and assemble assets, organizations, skills, and competences. It encompasses the team, partners, products, and processes.

Figure 2-1: Competitive Framework in the Supply Chain



Source: Ernst, 2002, p. 120

To understand the term of supply chain management in depth, first the term of supply chain will be explained, than management and the role of management as a base for complete definition of supply chain management.

According to Mentzer, et al. (2001, p. 5) the definition of “supply chain” is more consolidated as definition of supply chain management. In his paper, he tried to make a common definition of a supply chain, based on a comprehensive research study conducted by several co-authors. They came up with the following definition: **“A supply chain is defined as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer”**.

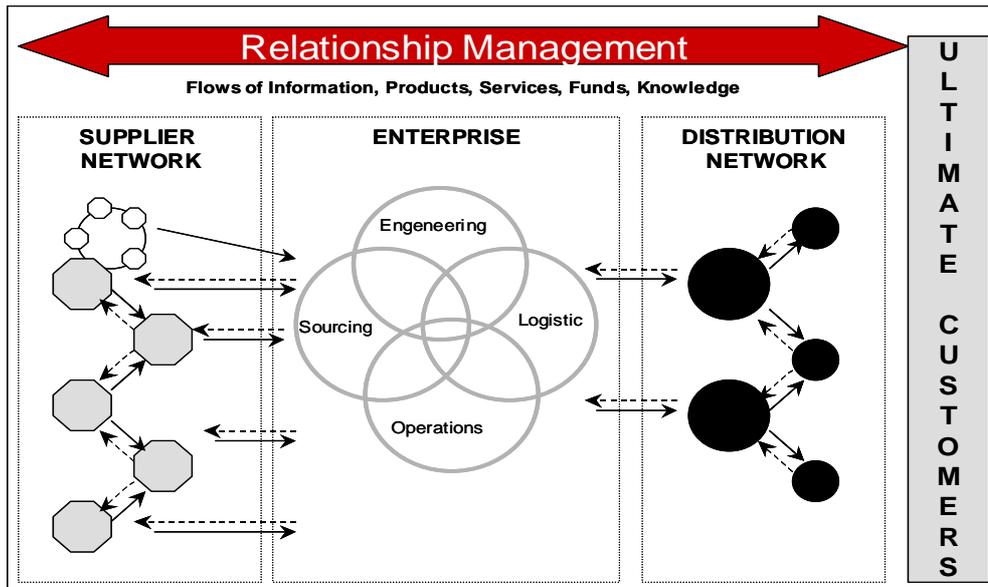
The supply chain may include internal divisions of the company as well as external suppliers that provide input to a focal company. A supplier for this company has his own set of suppliers that provide input (also called second tier suppliers). Supply chains are essentially a series of linked suppliers and customers until products reach the ultimate customer (Handfield, 2002, p. 9).

Supply chain of a company consists of an upstream supplier network and its downstream distribution channel (see Figure 2-2). Organizations can be part of numerous supply chains. Danfoss for example, is part of a supply chain for district-heating components, district-heating stations, and HVAC components. On the other hand, Alfa Laval can find Danfoss to be a supplier in one supply chain, a partner in another (developing components for their substations), a competitor in the fourth supply chain of stations, and as a customer in the heat exchangers supply chain.

Depending on how complex the supply network is, Mentzer (2001, p. 22) has defined three types of supply chains:

1. Direct supply chain, which consists of a company, a supplier, and a customer.
2. Extended supply chain, which includes suppliers of the immediate supplier, as well as customers of the immediate customer.
3. Ultimate supply chain, which includes all the organizations involved in all the upstream and downstream flows.

Figure 2-2: Supply Chain or Supply Chain Network



Source: Handfiled, 2002, p. 9

2.2. DEFINITION OF MANAGEMENT

The fact is that different supply chains in every day world exist whether they are managed or not. If none of the organizations will actively implement any of supply chain management concepts explained further on in the thesis, the supply chain as a phenomenon of business will still exist but will probably not act in a rational, coordinated way. Supply chain management therefore requires active **management** efforts by **the organizations** within the supply chain.

What is an **organization**? Lipovec (1987, p. 35) defines organization as the composition of relationships between people, who by relationships become members of a formed social unit. Organization ensures the existence and specific characteristics of the social unit and rational achievement of goals.

According to Rozman (2000, p. 15), there are **three processes** in an organization **assuring rational achievement of goals**: organizational process, coordination

process, and decision making process. The **organizational processes** are defined as goal oriented processes of ensuring the rationality of peoples' actions and behaviour and a rational achievement of the social unit's goal. Rationality is achieved through coordination. And **coordination** is conducted by taking care of the problems and by making appropriate **decisions**. Coordination in that context is the essence of achieving rational behaviour within an organization. It encompasses coordination of activities, goals, interests, and relationships. At the company level, we discuss coordination of business functions, business units, and projects.

And what is **management**? Longman dictionary of contemporary English defines management as:

- The activity of controlling and organizing the work that a company or organization does.
- The people who are in charge of a company or organization.
- The way that people control and organize different situations that happen in their lives or their work.

Most authors define **management as coordination of divided activities** (who does what) or **managerial process or functions** in an organization (Rozman, 2000, p. 7). Donnelly, et al. (1995, p. 4) define management as the process undertaken by one or more individuals to coordinate the activities of others to achieve results not achievable by one individual acting alone. Hellriegel and Slocum (1996, p. 302) define coordination as integration of the activities performed by separate individuals, teams and departments.

There are two interwoven processes in an organization that need to be coordinated: **a business and an organizational process** (Rozman, 2000, p. 6). A business process consists of: planning, executing, and control of business and organizational process consists of: planning organization, actuating, controlling organization. They are shown also in Table 2-1.

Table 2-1: Relations between Management, Business, and Organizational Processes

		Business processes	Organizational processes
Management processes	Plan	Business planning	Planning organization
	Execute	Execution of business	Actuating (Staffing/leading)
	Control	Control business	Controlling organisation

Source: Author, based on Rozman (2000, p.7)

As we can see also from Table 2-1, the result of dividing work between people in an organization is, that managers take over the organizational process and part of the business process (planning and controlling), while the execution is delegated to non-

managers. In that perspective, Pučko (2005, p. 2) defines management as a formal organizational process dealing with defining the goal or goals of the company, its policies, and process of executing the tasks performed by other people, by planning, organizing, leading and controlling.

Most authors do not distinguish between organizational and business processes in the same way. Therefore, management is most commonly defined as planning, organising, leading, and control. Those authors use planning meaning only planning of business; by organizing they mean establishing or planning an organization. Execution of business is not part of management, but the implementation of organization is part of management and is known also as staffing and leading. By control most authors understand the control of business and the control of organization or auditing (Rozman, 2000, p. 6).

Ernst (2002, p. 107) is an example of that as well. He defines **management as a match between organizational processes and managerial processes**. As organizational processes, he defines: work processes, behaviour processes and change processes. Within work processes, he defines operational processes (producing goods and services that external customers consume) and administrative processes (that are generating information and plans which internal groups will use). Work processes define critical activities needed to accomplish work and achieve set targets, behavioural processes describe the ways of acting/interacting and shaping the way in which work is conducted and decisions are made. Change processes are defined as a sequence of events over time that changes the organization according to the business requirements.

Ernst defines managerial processes as direction setting, negotiation, and selling, as well as monitoring and control process. The purpose, primary tasks, and critical skills of a management process are described in Table 2-2. The main purpose of direction setting is to establish direction and goals (part of business planning process as described earlier). The critical abilities of managers are to be able to make a synthesis and right decisions on the basis of analysis, set priorities and to communicate the plans.

Table 2-2: Management Processes, Purpose, Tasks, and Skills

	Direction setting process (Planning)	Negotiating and selling (Organizing & Leading)	Monitor and control
Purpose	Establishing organizational direction and goals	Obtain needed support and resources	Tracking ongoing activities and performance
Primary task	Developing an agenda	Building network	Collecting information
Critical skills	Synthesis, priority setting, communication	Timing and sequencing, framing and presentation	Questioning and listening, interpreting data

Source: Ernst (2002, p. 107)

The main purpose of negotiation and selling is to obtain necessary resources and support in an organization (can be also described as planning and actuating of an organization). The critical skills required are timing and sequencing of activities, as well as the ability to present the plans and to motivate people to achieve them. To be able to monitor and control an organization, in terms of how the ongoing activities are executed, the key skills required from managers are: the ability to question and listen to people as well as to interpret the information received in those conversations to be able to make right decisions.

Planning is therefore **one of the primary functions of management** and as Pučko (2005, p. 3) says, the main role is to define goals of the company and ways to achieve those goals. Ansoff (1990, p. 2-16) defines planning as designing the desired future and effective ways to achieve it. According to Rozman (1993, p. 24), planning is the process of creative thinking about the future that ends with a plan. This means the desired result and the ways to achieve it. Further, Rozman (1993, p. 72) describes planning mainly as a process of coordinating goals, strategies and targets, as well as decision-making, and delegating. The main purpose of planning is resolving and preventing problems, by evaluating different possible scenarios. On the other hand, the **organizational processes** create a certain structure of permanent relations among employees in the company. These relations enable execution of the plans and goals of the company. The most important in that sense is leadership, meaning communication and motivation of employees to execute the planned activities. **Controlling** is concentrated on auditing the behaviour of employees and achievements seen in relation to those planned and acting in case deviations appear.

We can conclude **that management is planning** (business planning and organisation planning; e.g. defining goals, policies and processes), **leading people** (e.g. delegating activities, communicating plans as well as motivating people) **and controlling** (auditing the behaviour of organisation and achievements). Business processes ensure efficiency and organizational processes ensure the rational achievement of the goals. The essence of achieving rational behaviour is **coordination** of activities, goals, interests, and relationships **to resolve conflicts** in organisation **by making appropriate decisions**. As business requirements are constantly changing, only a good match of business and organizational processes can ensure long-term efficiency.

The supply chain is defined as a set of three or more organisations directly involved in the flow of products or services to the ultimate consumer. This means that the supply organisations are big and management is traditionally spread among many functional managers. To assure **efficient coordination** of the decisions across the supply chain, integrated supply chain management is crucial.

The **essence of integrated supply chain management** is supply chain planning and control, which has three important dimensions. The first dimension is **functional integration**, which involves decisions about purchasing, manufacturing, and distribution activities within the company and between the company and its suppliers and customers. The second dimension is **geographical integration** of these functions across physical facilities located on one or several continents. The third dimension is **inter-temporal integration** of strategic, tactical, and operational supply chain decisions (Shapiro, 2001, p. 1). Functional and geographical integration is very tightly related to organizational processes including the definition of processes needed to execute the business. Inter-temporal integration of strategic, tactical, and operational supply chain decisions is related to business planning and controlling.

In a very simplified way, management can also be described as the art of getting things done through organizing other people in accordance with business plans. In terms of supply chain management, this involves all companies who are part of a supply chain.

2.3. DEFINITION OF SUPPLY CHAIN MANAGEMENT

Although industry and academia have investigated the concept of SCM for the last decade, there is still no consistent definition of the concept. As a result, there is generally a lack of consistency in meaning and clarity across the diverse definitions of supply chain management available in the literature. Some of them are listed further on.

Bolumole (2000, p. 2) has concluded that supply chain management offers an integrated philosophy for managing organizations' purchasing and distribution processes based on a marketing perspective. In her study, Persson (1997, p. 58) concluded that supply chain management is a homogenous management concept. The overall objective of supply chain management is to contribute to improvements in the company's bottom line or profitability. Related objectives include reducing the costs mainly by reducing the inventory level and increasing the revenues by improving customer service through **coordination and integration along the material flow, win-win relationships** and **end customer focus**. These imply that in order to achieve the objectives of supply chain management individual companies should coordinate and integrate their activities with other companies along the material flow in win-win relationships and focus their joint effort on the end customer.

The supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and

suppliers, but also transporters, warehouses, retailers and customers. Within each organization, such as a manufacturer, the supply chain includes all functions involved in fulfilling customer requests. These functions include new product development, marketing, operations, distribution, finance, and customer service. Supply chain management involves the management of flows between and within stages in a supply chain to maximize total profitability (Chopra, 2001, p.3).

Supply chain management is the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and a high level of information sharing to create high performing value systems that provide member organizations sustainable competitive advantage (Handfield, 2002, p. 8).

Although definitions of Supply chain management differ across authors, they can be classified in three categories (Mentzer, 2001, p. 8): a management philosophy, implementation of a management philosophy, and as a set of management processes.

2.3.1. Supply Chain Management as a Management Philosophy

Supply chain management as a management philosophy takes a system approach to viewing the supply chain as a single entity. This means that the partnership concept is extended into a multi-firm effort to manage the flow of goods from suppliers to the ultimate customer. Each firm in the supply chain directly or indirectly affects the performance of the other supply chain members, as well as the overall performance of the supply chain (Cooper, et al. 1997, p. 5).

Supply chain management as philosophy has the following characteristics:

- A systematic approach to viewing the **supply chain as a whole** and managing the total flow from the supplier to the ultimate customer.
- A strategic orientation toward **cooperative efforts** to synchronize and converge intra-firm and inter-firm operational and strategic capabilities into a unified whole.
- **A customer focus**, to create unique and individualized sources of customer value, leading towards customer satisfaction.

2.3.2. Supply Chain Management as a Set of Activities to Implement a Management Philosophy

When a company adopts a certain philosophy, a set of management practices must be established to ensure behaviour consistent with the philosophy.

The key activities needed for successful implementation of the supply chain management philosophy are (Mentzer, et al., 2001, p.10):

- Integrated behaviour.
- Mutually sharing information.
- Mutually sharing risks and rewards.
- Cooperation.
- The same goal and the same focus on serving customers.
- Integration of processes.
- Partners to build and maintain long term relationships.

Therefore supply chain management philosophy requires **extension of certain behaviour to external partners** (suppliers, customers) and in this context the philosophy of supply chain management turns into a set of activities that carries out the philosophy. One of the important aspects of an integrated behaviour is also **mutual sharing of information** among members of the supply chain. This is particularly valuable for the planning and monitoring processes. Open sharing of information such as inventory levels, forecasts, sales promotion strategies, marketing strategies, reduces uncertainty and increases performance. **Risk and reward sharing** helps maintain a focus on the long-term benefits and cooperation among the supply chain members. **Cooperation** on all levels among all processes in the supply chain is needed to reduce inventories and pursue supply chain-wide cost effectiveness. **Establishing the same goal and focus on serving customers** is a form of policy integration, which is possible if there are compatible cultures and management approaches among supply chain members. Implementation of Supply chain management requires **integration of processes** from sourcing to manufacturing, and to distribution across the supply chain (Cooper, et al. 1997, p. 12). This can be achieved via cross-functional teams, involving supplier personnel, and third party service providers. Supply chain management **requires partners to build up and maintain long-term relationships**. Cooper believes that the time horizon of the relationships extends beyond the lifetime of a contract and the number of the partners should be small to facilitate increased cooperation.

2.3.3. Supply Chain Management as a Set of Management Processes

Supply chain management is increasingly being recognized as the integration of key business processes across the supply chain. Implementation is carried through by three primary elements: the supply chain network structure, the supply chain processes, and the management components. In terms of supply chain network structure, it is important to integrate decisions related to purchasing, manufacturing, stocks, warehousing, and distribution, as well as define goals and strategies how to

achieve it. On the other hand, it is important to design a set of standard processes which will assure rational behaviour of the individuals or companies that are part of the supply chain. Last but not alt least, it is necessary to define control mechanisms to be able to audit performance of supply chain according to the plan, by coordinating activities and processes in order to build links between supply chain members and making the right decisions.

There are several organizations trying to set cross-industry standard processes such as Global Supply Chain Forum (GSCF), SCOR (Supply-Chain Operations Reference Model), CPFR (Collaborative Planning, Forecasting & Replenishment), and Rosseta Net, which can help members of a supply chain integrate efficiently. Further, CPFR and SCOR frameworks will be explained.

The **Global Supply Chain Forum** defines supply chain management as “the integration of key business process from end user through to original suppliers that provide products, services and information that add value for customers and stakeholders” (Lambert, 2005, p. 28).

The following **eight key supply chain management processes** are included in the framework (Cooper, 1997, p. 1-14):

1. Customer Relationship Management.
2. Customer Service Management.
3. Demand Management.
4. Order Fulfilment.
5. Manufacturing Flow Management.
6. Supplier Relationship Management.
7. Product Development and Commercialisation.
8. Returns Management.

The eight key business processes run along the supply chain and cut across firms and functional silos within each firm. Although functional expertise remains in place, implementing supply chain management requires making a transition from a functional organization to one focused on business processes, first within a company and than across the companies in a supply chain. While management teams of all firms in each supply chain should consider these eight processes, the relative importance of each process and the specific activities included may vary.

The Supply Chain Council developed another framework called **Supply-Chain Operations Reference-model** (SCOR). This process model is designed for effective communication among supply-chain partners. The scope of the SCOR model is defied as “From company’s supplier’s supplier to company’s customer’s customer” (Supply Chain Council, 2005). It is based on **five distinct management processes**

shown in Table 2-3. This definition is more useful also from Danfoss point of view as the processes that were implemented there are actually based on this model.

Table 2-3: Distinct Management Processes

SCOR Process	Definitions
Plan	Processes that balance aggregate demand and supply to develop a course of action which best meets sourcing, production, and delivery requirements.
Source	Processes that procure goods and services to meet planned or actual demand.
Make	Processes that transform a product to a finished state to meet planned or actual demand.
Deliver	Processes that provide finished goods and services to meet planned or actual demand, typically including order management, transportation management, and distribution management.
Return	Processes associated with returning or receiving returned products for any reason. These processes extend into post-delivery customer support.

Source: Supply Chain Council, SCOR Version 7, 2005, p. 7

Each of these processes is implemented in four levels of detail. Level one defines the number of supply chains as well as what metrics will be used. Level two defines the planning and execution process in material flow. Level three defines the inputs, outputs, and flow of each transitional element (Lambert, 2005, p. 29). Each process is analysed and implemented around three components: business process reengineering, benchmarking, and best practice analysis.

Both frameworks suggest implementation of standard cross-functional business processes, but as Lambert says, only these two include business processes specified in enough detail to be used by management to achieve cross-functional integration. The key differences between the two approaches are shown in Table 2-4.

Table 2-4: Comparison of Supply Chain Management Frameworks (GSCF, SCOR)

Criteria		GSCF	SCOR
Scope	Strategic driver	Corporate and functional strategies	Operations strategy
	Breadth of activities	All activities related to the successful implementation of the 8 business processes	All transactional activities related to demand-supply planning, sourcing, production, distribution and reverse logistic
Intra-company connectedness		Organization-wide cross-functional integration	Cross-functional interaction and information sharing
Inter-company connectedness		Relationship management	Transactional efficiency
Drivers of value generation		Economic value added	Cost reduction and asset utilization

Source: Lambert, 2005, p. 37

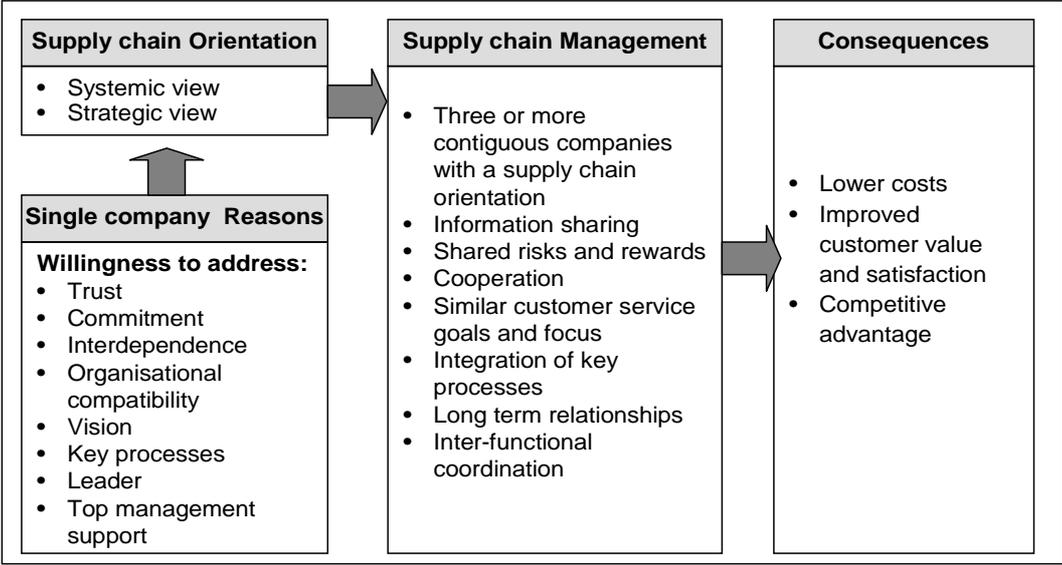
As Lambert (2005, p. 41) concludes, the difference between the SCOR and GSCF approaches lies in the fact that SCOR addresses symptoms through tactics. The GSCF framework, on the other hand, provides a strategic approach to address supply chain management processes incorporating the knowledge, expertise, and objectives of all functions. Thus, the two frameworks represent different ways of doing business.

2.3.4. Supply Chain Management versus Supply Chain Orientation

According to Mentzer, the idea of coordination of supply chain from an overall perspective (defined before as a management philosophy) is more accurately called **supply chain orientation**. The actual implementation of this orientation, across various companies in a supply chain is more appropriately called **supply chain management**.

In conclusion, **supply chain orientation** is defined as (Mentzer, 2002, p. 15): “Recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain”. The implementation of supply chain orientation requires several companies in the supply chain to utilize supply chain processes to realize the set of management activities defined in Figure 2-3.

Figure 2-3: Supply Chain Management Reasons and Consequences



Source: Mentzer, 2002, p. 16

From reviewing the literature on supply chain management, we can conclude that it is very difficult to make one universal definition of supply chain management, as standards regarding processes as well as terminology do not exist. However, it is also common in most of the authors’ definitions, that companies focusing on supply

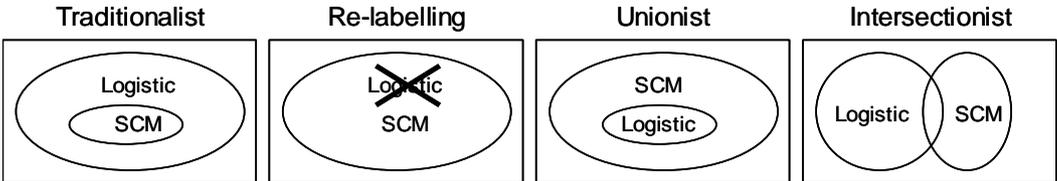
chain management can achieve competitive advantage by lowering costs and simultaneously improving customer satisfaction. They achieve that by optimising the complete value chain, seeking value creation opportunities by closer cooperation with their partners in the supply chain. This also requires advanced collaboration models (sharing information about demand on the market, integration of key processes and therefore long term relationships, as well as inter-functional coordination). On the other hand, it is crucial for successful cooperation that all parties involved in an integrated supply chain management have high level of trust among them. They need to be committed to a similar overall vision, have a compatible organizations, key processes, and most importantly, top management support.

2.3.5. Supply Chain Management versus Logistic

When defining supply chain management, it is common to relate it to logistics to better understand the approach, since the concept of supply chain management started in the logistics literature (Min, 2002, p. 770).

Halldorsson and Larson (2000, p. 220) show that supply chain management relative to logistics can be viewed in four different ways (see Figure 2-4). They propose that one reason for these multiple perspectives is that supply chain management has not been made transparent by one universal definition.

Figure 2-4: Perspectives of SCM versus Logistic



Source: Halldorsson, et al., 2000, p.220

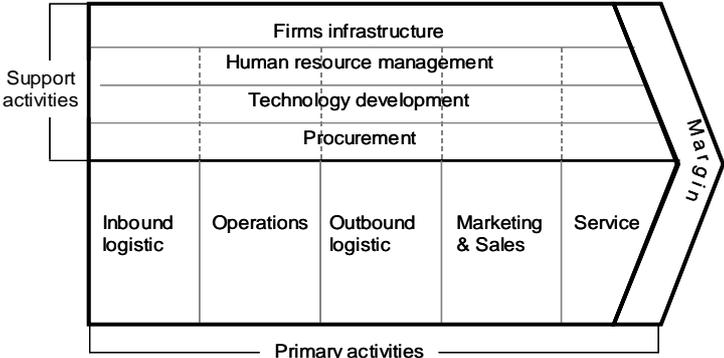
According to the Traditionalists view, the logistic function hires “supply chain analysts” to focus on cross-functional, and inter-organizational issues. Some authors do not distinguish between supply chain management and logistic. They just change the name. The Unionists view supply chain management as more than simply logistic, but rather also as purchasing, operations, and marketing. While Intersectionists, describe it as a staff function or internal consultants. SCM considers strategic, integrative elements from several functional areas (logistics, purchasing, operations, and marketing); however, it does not involve tactical elements, such as picking orders in a warehouse.

For the supply chain management implemented at DHBA, the most relevant definition from the ones mentioned above would be Unionist view of supply chain

management. This is because the supply chain management in DHBA involves all decisions along the flow of the goods (purchasing, manufacturing, logistic, customer service). Examples of such view are definitions from Christopher and Schary. Christopher (1998, p.17-21) defines supply chain management as an extension of logistic. Logistic is essentially a planning orientation and framework that seeks to create a single plan for the flow of products and information through a business. Supply chain management builds upon this framework and seeks to achieve linkage and coordination between processes of the entities in the pipeline. Schary also (1998, p. 7) sees supply chain as more than logistic. It includes the flow of materials and products to customers and more than that; it includes also the organizations that are part of these processes, crossing organizational boundaries to link their internal operations as part of this system. The supply chain recognizes that there are cooperative arrangements that tie firms to each other and in that way tie their success to the chain as a whole. The scope of supply chain spans the entire set of organizations from procurement of material and product components to delivery of the completed product to the final customer (Schary, 1998, p. 17).

The comparison of logistic and supply chain management can also be made on the basis of the value chain theory by Porter (1985, p. 33). Every company is a collection of activities that are performed to design, produce, and market, deliver, and support its product. They can be represented in a **generic value chain** shown in Figure 2-5.

Figure 2-5: Generic Value Chain

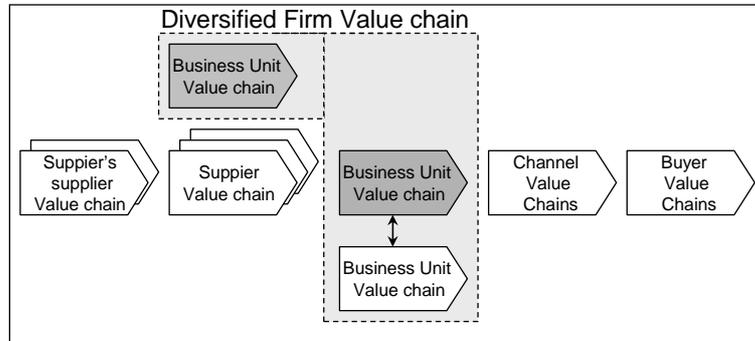


Source: Porter 1985, p. 36

Companies in the same industry may have similar chains, but the main competitors often differ. **Differences among competitors’ value chains** are a **key source of competitive advantage**. A company’s value chain is embedded in a large stream of activities called the value system (Porter, 1985, p. 34). Suppliers deliver not only a product but can also influence a company’s performance in many ways (Figure 2-6). On the other hand, the product very often passes through value chains of different distribution channels on their way to the buyer. Also, distribution channels perform additional activities that affect the buyer as well as the company’s activities. The

ultimate basis for differentiation is a firm and its product's role in the buyer value chain that determines the buyer's needs. **Gaining and sustaining competitive advantage depends on understanding, not only the firm's value chain, but also how the firm fits into the overall value system.**

Figure 2-6: The Value System



Source: Porter, 1985, p. 35

We can use the value chain model shown in Figure 2-6, for defining logistic in relation to supply chain management. Logistic is concerned with optimising material and information flow for a business unit, by optimising logistic processes, such as planning, distributing, and warehousing within a single business unit. Supply chain management explores value creation opportunities along the entire supply chain. Such opportunities start with exploring customers' needs and suppliers' capabilities and continue with an evaluation of common improvement opportunities. Those efforts can result in joined product development projects, process integration, joined information sharing, integrated planning, or marketing activities with the aim to improve the overall performance of parties involved. An example of such activities can be the joined process development of stock planning and control, not only for the business unit, but for the complete channel as the knowledge of the products and flexibility limits of supply chain are most known in business unit not further up in the channel. The benefit of such activity is for both partners. In the focal business unit the benefit is that the demand is more stable and that requires less flexibility and lower costs. On the other hand, the channel value chains do not need to focus on stock planning and control as this is already done by the business unit, so the management cost related to control those activities is lower as well.

2.4. DRIVERS OF SUPPLY CHAIN DEVELOPMENT AND MAIN INITIATIVES

In today's **global** economy, companies face increasing pressure to reduce costs while maintaining production and quality levels to deliver results. In order to achieve these goals, companies must successfully overcome a number of challenges. As

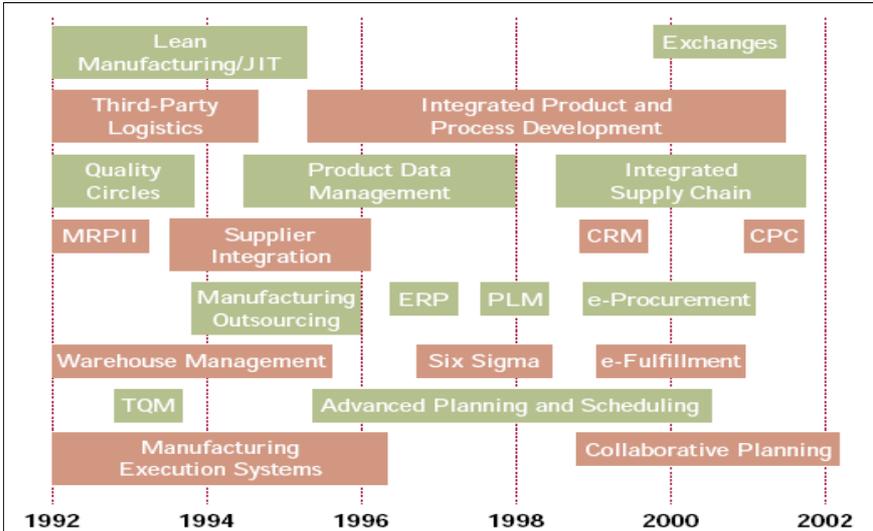
Meakem (2003, p. 1) points out, free market economies and new technologies are creating new supply-and-demand markets around the world. Many organizations, for instance, are looking for supply from China. But a good number of these organizations lack the information and knowledge necessary to drive more supply and production offshore. The rules of free market global competition dictate that only the strong survive. As a result, industries around the world are **consolidating** at a rapid rate. Mergers and acquisitions are a primary means of achieving consolidation. But unless synergies between combining entities can be realized, consolidation rarely works. Global competition and **improved technology** are shortening time-to-market and order-to-delivery times. This, in turn, requires organizations to select the best suppliers and pull them into core enterprise activities. Organizations across geographies and industries are scrutinizing **make-versus-buy** options. And many are finding increased value in **outsourcing** production of goods and services.

Handfield (2002, p. 11) summarise drivers into:

- Ever-increasing customer demand in terms of product and service cost, quality, delivery, technology, and cycle time brought about by global competition.
- The emergence and greater acceptance of higher-order cooperative inter-organizational relationships.
- The information revolution.

The consequence of this development is that companies are putting more and more effort into developing new ways to increase competitiveness on the market in terms of more efficient and effective supply chain management. Results of these efforts are numerous supply chain initiatives, emerged in the last decade, as shown in Figure 2-7.

Figure 2-7: A Decade of Supply Chain Initiatives



Source: Accenture, 2002, p. 3

But development goes on. The latest initiatives in the field of supply chain according to Anderson (2003, 7) are:

- **Design for supply chains:** customer-driven design, collaborative design, leveraging research, and development assets.
- **e-Marketplaces:** industry-vertical e-Marketplaces, private exchanges, horizontal aggregators.
- **Collaborative manufacture:** transactional integration, collaborative integration, networked integration.
- **Integrated fulfilment:** logistics postponement, resource exchange, leveraged shipments, Clicks-and-Mortar model.

The common characteristic of all initiatives is that they require a high degree of collaboration on different levels of processes involved in delivering the product to the customer as well as advanced use of information technology.

A growing number of companies are implementing supply chain management practices. Moreover, although many companies express enthusiasm for cross-functional collaboration, both within the enterprise and with supply chain partners, in reality, very few companies have successfully implemented the practices and technologies needed to do it well. The use of different practices is highly connected with the level of supply chain process development as well as the level of integration of these processes.

2.5. DIFFERENT INITIATIVES AND LEVELS OF SUPPLY CHAIN MATURITY

To evaluate how good companies are in using emerging supply chain practices and how successful they are in choosing the right ones, Performance Management Group (PMT) and consulting company Pittiglio Rabin Todd & McGrath (PRTM) jointly developed the Supply Chain Maturity Model (Figure 2-8). The model is based on a combination of benchmarking experience and field knowledge of current and emerging practices across different industries over the past five years.

The model defines four stages of operational capability. Companies almost always progress through the stages in sequence, by building on the practices they have solidly established at each stage. Attempts to advance without a base of firmly established practices are rarely successful (Cohen, 2004, p. 274):

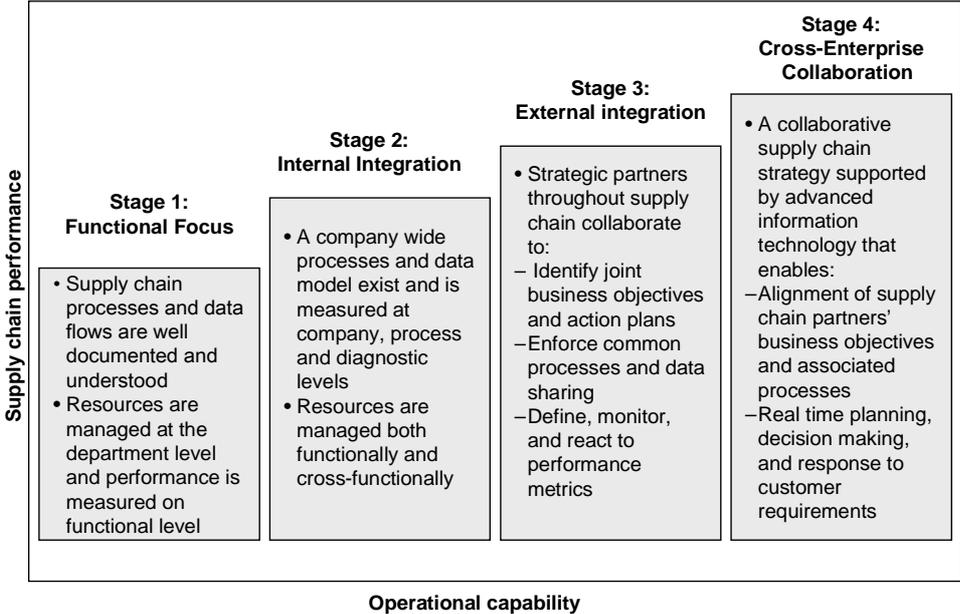
Stage 1—Functional departments within an organization focus on improving their own process steps and use of resources. Managers typically focus on their individual

departments' costs and functional performance. Processes that cut across multiple functions or divisions are not well defined or understood, resulting in limited effectiveness of complex supply chain processes.

Stage 2—Division or company-wide processes are now defined, allowing individual functions to understand their roles in complex supply chain processes. Cross-functional performance measures are clearly defined, and individual functions are held accountable for their contributions to overall operational performance. Resource requirements are typically balanced across the organization. A well-defined demand/supply balancing process that combines forecasting and planning with sourcing and manufacturing is evident at this stage.

Stage 3—Stage 2 practices are now extended into the points of interface with customers and suppliers. The company has identified strategic customers and suppliers, as well as the key information it needs from them in order to support its business process. Joint service agreements (JSA) and scorecard practices are used, and corrective actions are taken when performance falls below expectations.

Figure 2-8: Levels of Supply Chain Maturity



Source: Cohen, 2004, p. 231

Stage 4—Customers and suppliers work strategically to define a mutually beneficial strategy and set real-time performance targets. Information technology now automates the integration of business processes across these enterprises in support of an explicit supply chain strategy.

The model also evaluates the extent to which information technology enables richer practices and cross-enterprise integration in supply chain management.

2.6. LEVELS OF SUPPLY CHAIN MATURITY AND BUSINESS RESULT

To evaluate the impact of supply chain development or maturity level on company performance, the Performance Measurement Group (PMG) conducted a survey in 2003 where the relationship between companies' supply chain capabilities and their performance was investigated.

The main conclusions from this study were:

- The survey found that 36% of the responding companies' practices are at the **mature stage 2.3**. They expect to achieve the average of 2.9, by the end of 2003.
- **Maturity differs widely among industry segments.** Consumer goods companies are currently the leaders in supply chain practice maturity (average of 2.5), due to an ongoing focus on cost management and reduction. At the other end of the spectrum, life sciences companies remain more functionally focused (average of 1.9).
- Analysis also showed that **mature companies outperform their peers** in three of the four supply chain performance areas: **delivery, flexibility and responsiveness**, and **cost**. The fourth performance area - **asset turns** - does not directly correlate to supply chain maturity as it is defined by this study. In addition, mature organizations have a 10-25% advantage in three components of overall supply chain management costs - order management, materials acquisition, and inventory carrying. As a result, total supply chain costs for mature companies only amount to 9% of the revenue on average, versus 10.7% in immature companies. Mature companies can deliver products six days faster, meet customer requirements almost 100% of the time, and have total supply chain management costs that are 20% lower.
- The research showed high **correlation between supply chain maturity and financial performance**. Mature companies leverage their supply chain expertise to achieve an overall business advantage. In fact, based on earnings before interest and taxes (EBIT), mature companies are 40% more profitable. Although other factors, such as product innovation and channel management, likely contribute to this profit edge, supply chain management is a key driver. Besides having lower cost of goods sold (COGS) as a percentage of revenue, best performers are continuing to reduce COGS overall, while their competitors are actually seeing these costs increase.
- **Best in class practice:** Improvement in "overall" supply chain management lags behind the four process components. Make and deliver process are often the "low hanging fruit" of supply chain improvement efforts - far more visible and easier to understand than plan. But the companies that were best in class (the top 20%) in the key metrics had uniformly higher levels of plan practices in place.

Also, this study as many others that can be found in the literature, confirms that supply chain management can contribute significantly to service level improvement as well as cost optimisation which is closely linked to the financial performance of the company and is therefore seen as a key driver of long term competitiveness of the companies. Given the correlation between mature supply chain practices and financial performance, the companies were also asked how much they expect to increase their development level in the next two years. Participants expect to advance only about 0.6 stages of maturity over the next two years. These expectations reflect their understanding of the challenges involved in developing new supply chain capabilities and practices.

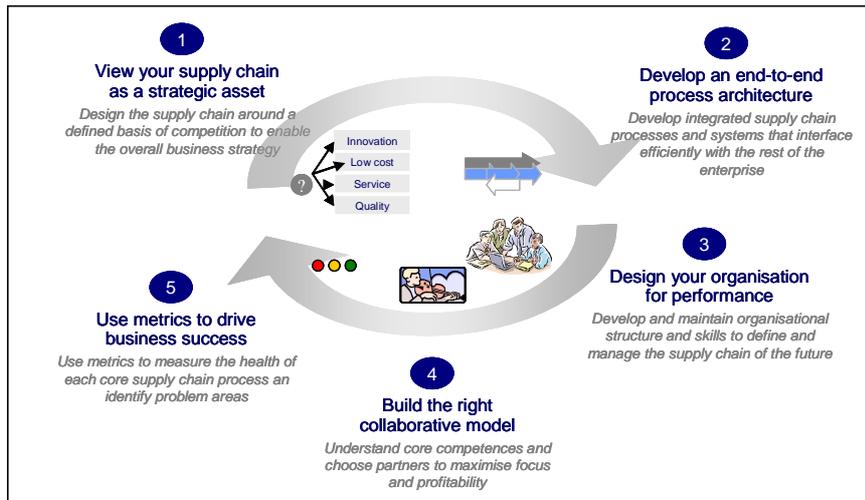
3. KEY COMPONENTS OF SUCCESSFUL SUPPLY CHAIN MANAGEMENT

As discussed earlier, the level of supply chain maturity drives both supply chain and financial performance. However, companies must select supply chain practices that are most aligned with their supply chain strategy and overall business. Blind adoption of generic supply chain best practices may allow a company to catch up with its industry peers, but it won't create a basis for competitive advantage. The question is **how to develop** necessary **supply chain capabilities and select the critical best practices**, those that will drive a company's strategic objectives forward. To be able to do that, PRTM has developed the **framework** for successful supply chain management based on **five core disciplines** (Cohen, et al., 2004, p. 12). The framework takes into account a broader perspective of supply chain management, extending it beyond processes only (as they are defined in SCOR model). It is in a way also a logical answer to research conducted by Lambert, where the strategic aspect in the SCOR model itself is not that explicit, as it is based more on tactics and cost reduction focus.

Those core disciplines are (see Figure 3-1):

- To view supply chain as a strategic asset (designed around a defined basis of competition to enable overall business strategy).
- To develop end-to-end processes and systems to interface efficiently with the rest of the organization.
- To design organization and necessary skills required.
- To build the right collaborative model based on core competences and selection of the right partners, to maximize focus and profitability.
- To use metrics to measure the health of the processes and identify problem areas.

Figure 3-1: Five Core Disciplines for Strategic Supply Chain Management



Source: Adapted by Cohen, et al., 2004, p.12

We can relate this framework very closely to the definition of management stated in the second chapter. There we have defined management as planning (business and organisation), leading and controlling. The view of supply chain as strategic asset is related to business planning. Organisational planning is connected to developing end to end processes, designing organisation and building the right collaborative model, while metrics is related to controlling. Leadership is, on the other hand, one of key components of successful implementation of those plans and is therefore the key skill of managers.

3.1. SUPPLY CHAIN AS A STRATEGIC ASSET

When companies view supply chain as a strategic asset, supply chain strategy is part of the overall business strategy, designed around a well-defined basis of competition (innovation, low cost, service, quality). It is integrated with marketing strategy and with customers' needs, product strategy as well as power position. On the other hand, supply chain strategy must adapt as market conditions and competitive advantages change.

In that way, supply chain strategy designs a unique supply chain configuration that drives strategic objectives forward. A supply chain strategy consists of five building blocks (Cohen, 2004, p. 10):

1. Manufacturing strategy.
2. Outsourcing strategy.
3. Channel strategy.
4. Customer service strategy.
5. Asset network.

3.1.1. Supply Chain Strategy Building Blocks

Manufacturing strategy means deciding, how to produce products or services. Will products be made to stock, to orders or some combination of it? Will some of the manufacturing be outsourced or production moved to low cost countries? Will final configuration be completed outside the manufacturing plant, closer to customer?

Changing the manufacturing strategy can be a key source of competitive advantage. Sometimes, it can also be an advantage to choose different manufacturing strategies for different products or different markets. The key drivers of manufacturing strategy are product life cycle, demand changes, and the number of product variants. Types of manufacturing strategies appropriate for different products are shown in Figure 3-2.

Figure 3-2: Types of Manufacturing Strategy

Strategy	When to choose this strategy	Benefits
Make to stock	For standardised high volume products	Low manufacturing cost, meeting customer demands quickly
Configure to order	For products requiring in many variations	Customisation, reduced inventory, improved service levels
Make to order	For customised products with infrequent demand	Low inventory levels, wide range of product options, simplified planning
Engineer to order	For complex products that meet unique customer needs	Enables response to specific customer requirements

Source: Cohen, et al., 2004, p. 12

Channel strategy defines how products or services will be delivered to buyers or end users. It needs to answer questions such as: Will the product be sold via distributors? Which market and market segments will be served, which channel will be used, priorities in case of material shortage? Will dedicated inventories for strategic partners be kept? The decisions regarding company's assets and cost performance must be part of the channel strategy, including pricing, promotions, financing and other terms and conditions.

Anderson (1999, p. 5) suggests the set of strategies that deal more with tighter collaboration with the channel, the customer, and/or the end consumer:

- **Consumer Customizer:** Uses mass customisation to build and maintain close relationships with end consumers through direct sales.
- **Trade Focused:** Like logistics optimisation, this strategy puts a priority on "low price, best-value" for the consumer, but it focuses less on brand than on dedicated service to trade customers.
- **Logistics Optimiser:** Emphasizes a balance of supply chain efficiency and effectiveness.

The decisions regarding **outsourcing** are an important source of flexibility. Through outsourcing, the company can focus on core competences and enhance their competitive positioning. Outsourcing of activities, with low strategic importance, or activities that outsourcing partners can do: better, faster, or cheaper, are the areas to be considered. If the product, process, or technology is the source of a company's differentiation, it should not be outsourced. Nevertheless, before any final decision is made, risks and strategic implication should be evaluated.

Customer service strategy should be based on two things: the overall customer volume and profitability, and understanding, what customers really want. Should the company aim for different service levels depending on customer importance? Tailoring customer service strategy to deliver the best cost/service performance by customer segment can have a high yield.

The final decision concerns the supply chain network, factories, warehouses, production equipment, order desks, and service centres. Location, size, and mission of these **assets** have a major impact on performance. Depending on business size, customer service requirements, tax advantages, supplier base, labour cost companies can choose among: global, regional, or country manufacturing model. The company can chose different models depending on the type of demand for their products. High volume products can be produced in low cost countries for a global demand. Another option is also with use of different "in market" postponement strategies. This means that the standard product is produced in a low cost production centre but final configuration and packing are done at distribution point, close to customer. Another aspect is the product life cycle. In the beginning of the life cycle a global model can be used to develop manufacturing processes, later on a regional model should be used to improve customer service.

3.1.2. Key Criteria for a Good Strategy

Supply chain strategy supports and drives **business strategy** forward. Effective business strategy begins with the core strategic vision that lays down the framework for the business. Business strategy defines what the company is, what it does, and what it doesn't do (Cohen, 2004, p. 20). In that way it also defines basis of competition in terms of: innovation, cost, service, and quality. Leading edge companies are focusing just on one of the four.

Good business strategy is very important from the supply chain perspective, as each basis of competition requires a different network structure, processes, information systems, and skills as shown in Table 3-1. If the cost is the source of competitive advantage, the focus is on efficient operations, the basis of competition are the

lowest prices in the product category and supply chain can contribute to achieving competitive advantage by low cost and efficient infrastructure.

Table 3-1: Supply Chain Contribution to Business Strategy

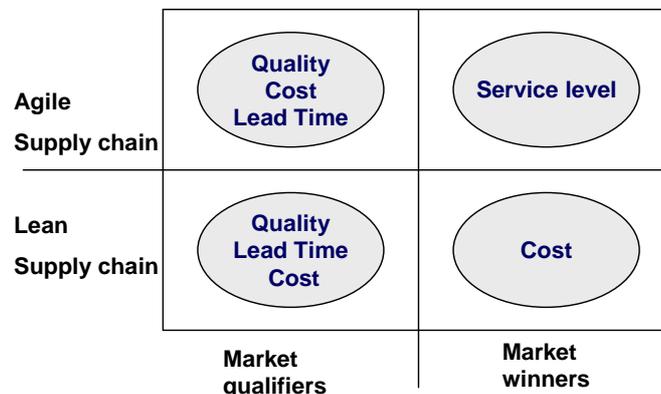
Primary strategy	Source of advantage	Basis of competition	Key supply chain contributor
Innovation	Brand and unique technology	Desirable and innovative products	Time to market and time to volume
Cost	Cost efficient operations	Lowest prices in the product category	Efficient low cost infrastructure
Service	Superb service	Tailored to meet customer specific needs	Designed "from the customer in"
Quality	Safest, most reliable products	Products you can count on	Supply chain excellence and quality control

Source: Cohen, et al., 2004, p. 22

As Cohen states, good supply chain strategy must meet **four criteria**. It has to be **aligned with business strategy, customer needs, and power position** and it should be **adaptive**.

Companies need to know what customers really want. Thus, the strategy needs to be **aligned with customer needs**. Lean principles need to be applied where cost is the market winner and agility principles need to be applied in markets where availability is the market winner (Figure 3-3).

Figure 3-3: Market Winners – Market Qualifiers Matrix for Agile versus Lean Supply Chain



Source: Adapted by Mason Jones, 2000, p. 65

Depending on market requirements, there are actually three dimensions: product characteristics, demand characteristics, lead time characteristics.

According to these, we can group supply chains into (Corsten, Longitudes 04, 2004, p. 10):

- **Lean supply chain** has high fixed assets and the focus is on high capacity utilization and efficiency (e.g. automotive).

- **Agile supply chain** has low fixed assets, shorter innovation cycle, assembly is often modular, and flexibility is a key due to rapidly changing product requirements.
- **Fast supply chains** can be found in consumer products industries, as innovation cycles and shelf life are very short, and speed is crucial.
- **Linked supply chain** is typical for industries with long innovation cycles such as pharmaceutical or chemical industry, where raw materials go through a sequence of steps.

Fisher (1997, p. 114) has classified supply chains into functional or innovative with reference to the type of demand for product. The criteria for this distinction and requirements on supply chain are presented in Appendix (Figure A-1). According to the type of demand, companies must design processes that focus on efficiency or responsiveness. Functional products require an efficient process, while innovative products on the other hand a responsive one.

According to Fisher (1997, p. 114), companies are very often found in the right upper corner in the Figure 3-4. The core reason lies in the fact, that companies have difficulties in accepting uncertainty as inherent to an innovative product. They can employ three coordinated strategies to reduce uncertainty. One of them is to increase the share of common components that consequently increases predictability of demand. They can also avoid uncertainty by reducing lead-times or hedge against remaining uncertainty by buffers of inventory or excess capacity.

Figure 3-4: Matching Supply Chain with Products

	Functional products	Innovative products
Efficient supply chain	match	mismatch
Responsive supply chain	mismatch	match

Source: Fisher, 1997, p. 109

For a good supply chain strategy, it is very important that the company understands the power and influence relative to customers and suppliers. Therefore, it needs to be **aligned with its power position**. Companies with high power and influence can leverage their volume to get things cheaper, have better control over the supply chain, its structure, customers, and suppliers. The brand plays an important role in the cooperation with customers. The impact of power position is biggest on the relationship management in supply chain. The company can either control supply chain partners or collaborate with carefully selected partners, depending on their real

strategic impact. Anderson (1999, p.5) suggests six strategies that directly support business strategies focused on product leadership and brand-building:

- **Market saturation driven:** focuses on generating high profit margins through strong brands and ubiquitous marketing and distribution.
- **Operationally agile:** configures assets and operations to react nimbly to emerging consumer trends.
- **Freshness oriented:** concentrates on earning a premium by providing the consumer with a product that is fresher than competitors offering.

Supply chain strategy **needs to be adaptive** as business strategies evolve and new technologies emerge. Internal and external factors determine the life cycle of a company's strategy:

- A new technology that transforms the dynamics of the industry (e.g. internet).
- A change of the scope of the business (new products or service, new markets, geographical expansion, distribution capabilities, new channels, new suppliers).
- A change of basis of competition due to a new competitor.
- The need to assimilate new acquisitions.

3.2. KEY SUPPLY CHAIN PROCESSES

No matter what strategy the company has chosen for their supply chain, the implementation of that strategy should include architecture details in processes, applications, and information. Process architecture has four main components (Cohen, et al., 2004, p. 50):

1. A description of supply chain processes and how they relate.
2. A view of the interactions between the supply chain processes and the rest of the core enterprise processes.
3. A description of the IT applications required to support supply chain processes, including the data and performance indicators needed for execution and control.
4. A description of how the applications will be integrated, including specification of data and frequency of communications.

According to Cohen, effective supply chain processes in the company should:

- **Fit to supply chain strategy** and support the basis of competition.
- Ensure **end-to-end management**, by having the same vision and set of shared objectives.
- Be **simple**, easy to understand, to reduce complexity, which adds to cost and decreases manageability.
- Have an adequate level of **integrity** in terms of integrated applications, accurate data, and documented processes.

The company must **pick the state of the art practices** and processes that **really fit the strategy** to improve the basis of competition and avoid the trap of choosing costly cutting edge practices that provide only marginal support. Some examples of critical supply chain practices that fit a certain strategy are listed in Figure 3-5.

Figure 3-5: Supply Chain Practices and Basis of Competition

Primary strategy	Critical Supply chain Practices
Innovation	<ul style="list-style-type: none"> • Design chain / supply chain integration • Collaborative innovation with suppliers • Dedicated new product innovation supply chain
Cost	<ul style="list-style-type: none"> • Integrated factory planning and scheduling • Raw materials and manufacturing processes standardization • Design for manufacturing, procurement, order management
Service	<ul style="list-style-type: none"> • Customer collaborative planning • Customer segmentation • Postponement
Quality	<ul style="list-style-type: none"> • Product and lot-level traceability • Life cycle tracking of sold products

Source: Cohen, et al., 2004, p. 52

As presented in Figure 3-5, if the cost is the primary source of competitive advantage the state of the art practices that can support those strategies are related to integrated factory planning and scheduling, raw materials and manufacturing process standardisation. Also, design of the products needs to be suitable for efficient manufacturing, procurement and order management. When company is competing on superb service, the processes that are critical are related to collaborative planning with customers, segmentation of customers to be able to satisfy different customer segment needs as well as possible, and differentiation of products as late in the process as possible to adapt to customer changed demands as fast as possible, which is also called postponement.

The supply chain process architecture has to be changed as a company’s strategy changes. Further, the company needs to evaluate where process integration, internal or external, can create value for the company. This implies that the focus should be on **end-to-end supply chain management**. When processes fulfil the goal to have an end-to-end focus, they are:

- Integrated within and beyond organization (key customers and suppliers).
- Supply chain resources are optimised across the supply chain.
- Standard metrics and objectives are shared across the supply chain.
- Performance visibility and management are shared.

Complex supply chains are difficult to understand, improve, and manage. In consequence, the supply chain **should be simple** to overcome these problems. Drivers of complexity are:

- Supply chain configuration.
- Products and services proliferation.
- Process and information systems inconsistency.
- Over automation.

To simplify the processes the company should (Cohen, et al. 2004, p. 63):

- Set the rules.
- Measure and manage products, service complexity, and related costs.
- Define and adhere standards for components and materials.
- Review the physical supply chain configuration (warehouses, order desks, factories, supplier locations, distribution centres) regularly and simplify it where possible.

Accurate data and documented processes are very important for the success of the **process architecture integrity** in terms of integrated applications. This actually means that the required level of integration between applications is defined, that processes are documented at each level of supply chain, with clear descriptions and data required to execute them, and that data quality is measured and managed, with clear ownership for creation and maintenance.

Companies across industries most widely accept SCOR model as the tool for process architecture. Through the structure and method, SCOR model helps to make supply chain process architecture manageable.

3.3. DESIGN OF SUPPLY CHAIN ORGANISATION

Integration is the essence of supply chain management. This means that if the company wants to provide effective supply chain management core supply chain processes as defined by SCOR model should be integrated in one organization, under one senior manager. The challenge is to determine the structure of organization, roles and responsibilities, as well as finding the right people with the right skills.

Supply chain organization, as any other organization, evolves constantly. Depending on changed business requirements or identified improvement initiatives; the roles and responsibilities might change, as well as goals and priorities. This also means that new competences need to be developed while some of them may be obsolete.

Effective supply chain organization must have the following characteristics (Cohen, et al., 2004, p. 108):

- Supports overall business strategy.
- Provides skills and core competences – either internally or through strategic partnerships – needed to execute all supply chain processes.
- Has metrics in place to measure performance.
- Follows a set of practical design principles.

The organization (structure and processes) needs to be reviewed periodically to ensure that strategic business development is supported and that people assigned to different roles have the technical and managerial skills to execute their defined responsibilities effectively.

Over time, organization has evolved significantly. From functional supply chain organization, where order management and purchasing were separated from Operations, in the 1980s and 1990s companies began the transition to an integrated management of functions critically related to the core supply chain, and purchasing became part of operations as well. Supply chain management emerged in 1990s. In an integrated supply chain organization, the supply chain manager has full responsibility for all supply chain processes from order management to order fulfilment, manufacturing, and purchasing (Cohen, 2004, p. 110).

There is no unique way to design an effective supply chain organization; however four guiding principles can be used:

- Form should follow function – organization should mirror the processes.
- For every process, an assigned accountable (function or individual).
- Know, grow, and keep core capabilities.
- Organize around the skills needed and not around the skills available.

Internal capabilities can be considered as core when they are defined as a competitive advantage or are otherwise essential for achieving the company's strategic objectives. When something is defined as a core competence, its quality should be at a high level. The activity can be defined as core competence if it is critical to (Cohen, et al., 2004, p. 121):

- Competitive advantage.
- Business growth.
- Customer service.
- Superior offerings.

Well-trained, knowledgeable people are the key to developing core competences. State-of-the-art systems are no replacement for human beings. They can provide a

much higher degree of decision support, but they demand sophisticated users. In other words, technologies do not deliver the result, people do.

Effective organization requires the right skills and capabilities. After defining the organization around the processes, identification of skills that are needed for each role is very important. The critical jobs according to Cohen are described in Figure 3-6.

Figure 3-6: New Roles for End-to-End Supply Chain Management

New role	Key required skills
Outsourcing partner Relationship manager MAKE	<ul style="list-style-type: none"> • Ability to negotiate strategic alliances and partnerships • Ability to drive best-in-class performance from supply chain partners • Ability to inspire individuals within various organisations to work collaboratively
Global commodity manager SOURCE	<ul style="list-style-type: none"> • Ability to manage across continents • Ability to manage ongoing relationships with key suppliers and to execute the global supply chain strategy for products purchased from this suppliers • Ability to structure the supply base to achieve the lowest total cost of ownership • Ability to manage suppliers through objective measurements and regular generation of formal suppliers scorecards
Customer relationship manager DELIVER	<ul style="list-style-type: none"> • Deep understanding of the customer's business and channels • Sufficient understanding of supply chain operations to ensure implementation of core processes that supports customer requirements
Supply chain process improvement manager PLAN	<ul style="list-style-type: none"> • Thorough understanding of supply chain best practices • Ability to inspire individuals within multiple functions to work collaboratively • Ability to recognise opportunities for process improvement and appropriate automation
Supply chain performance analyst PLAN	<ul style="list-style-type: none"> • Thorough understanding of supply chain metrics and appropriate method for target setting • Ability to institutions metrics-driven reviews and continuous improvement programs

Source: Cohen, et al., 2004, p. 129

It is typical of the most roles, that the ability of cross-functional and organizational collaboration is crucial, which also implies a high degree of relationships management and therefore requires good leadership skills related to communication and motivation of people involved in making improvements.

3.4. DEVELOPMENT OF A COLLABORATIVE MODEL

3.4.1. Definition of Collaboration

As companies migrate toward more extended supply chains, collaboration is becoming their most strategic activity (Accenture, 2003, p. 11). Collaboration can

have a variety of meanings but for the purpose of this thesis I will adopt the definition from Cohen (2004, p. 139): “The means by which companies within the supply chain work together toward mutual objectives through the sharing of ideas, information, knowledge, risks, and rewards”.

Drivers of collaboration include the desire to access (Cohen, 2004, p. 140):

- Technology owned by another company.
- A technology that is too capital-intensive for the company to invest in alone.
- A competency that is too costly to acquire, develop, or maintain.
- A new market effectively closed off by high entry cost or preconditions (trade barriers, legislation).

True collaboration is very difficult, and there is no point in it unless financial or strategic gains can be achieved. Potential collaboration partners are customers, material suppliers and suppliers of services that support supply chain operations. Cohen (2004, p. 143) distinguishes different levels of collaboration with respect to their model of maturity:

- Transactional collaboration (efficient execution of transactions among partners).
- Cooperative collaboration (requires a higher degree of information sharing such as demand plans, order confirmations, inventory levels, and delivery status. The main technology used is EDI - Electronic data interchange).
- Coordinated collaboration (Coordinated relationship requires more close relationships as partners rely on each others' capabilities. It is used for strategically critical supply chain partners. An example of it can be VMI-Vendor-Managed Inventory, where suppliers are responsible to maintain agreed stock levels, based on usage or forecasts).
- Synchronized collaboration (Collaboration here moves beyond borders of supply chain operations to joint development projects. They can be called strategic alliances).

The following issues are important factors of successful collaboration (Cohen, 2004, p. 148):

- Company must master internal collaboration first.
- The proper degree of collaboration needs to be defined for each partner segments. Partners must be carefully selected, depending on strategic importance, cultural fit, organizational fit, and technology fit. The processes have to be linked with each of these key partners, and type and level of integration that applies to each process link have to be carefully evaluated.
- Benefits, gains and loses, risks are shared. The overall objective of collaboration is that it is more profitable for all parties involved. Supply chain partners need to evaluate their relative strengths and capabilities openly and critically. Implicit in this process is the requirement to "open the books" to managers outside the

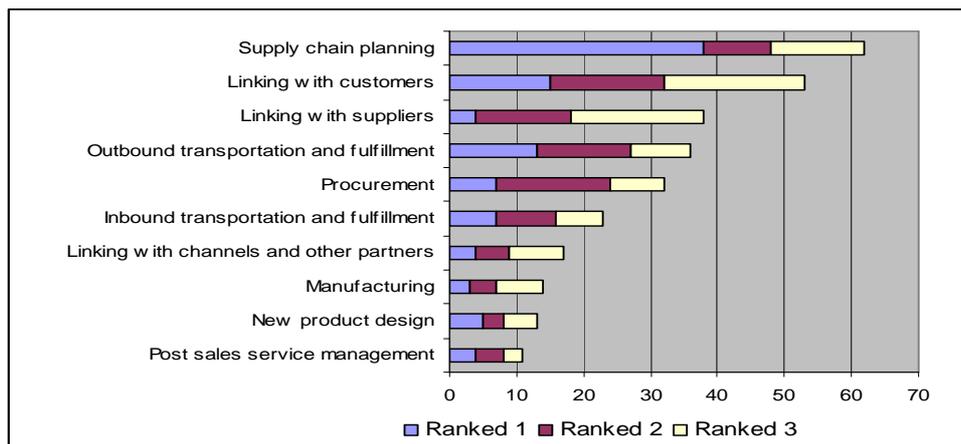
corporate boundaries of one particular firm where cross-company and cross-functional teams can analyse cost structures and performance metrics. Trust is the key component if supply-chain partners want to collaborate strategically, rather than only on a tactical level.

- Clear objectives and metrics regarding acceptable performance must be set and clearly understood.
- Use of technology. Today’s collaboration tools focus on supply chain event management and on relationships between customers and suppliers.

3.4.2. Key Areas with Increasing Need for Collaboration

The Global Study of Supply Chain Leadership and its Impact on Business Performance has identified key areas where companies should collaborate (Accenture, 2003, p. 3). Those main areas are shown in Figure 3-7.

Figure 3-7: Supply Chain Collaboration Areas with Highest Potential



Source: Accenture, 2003, p. 11

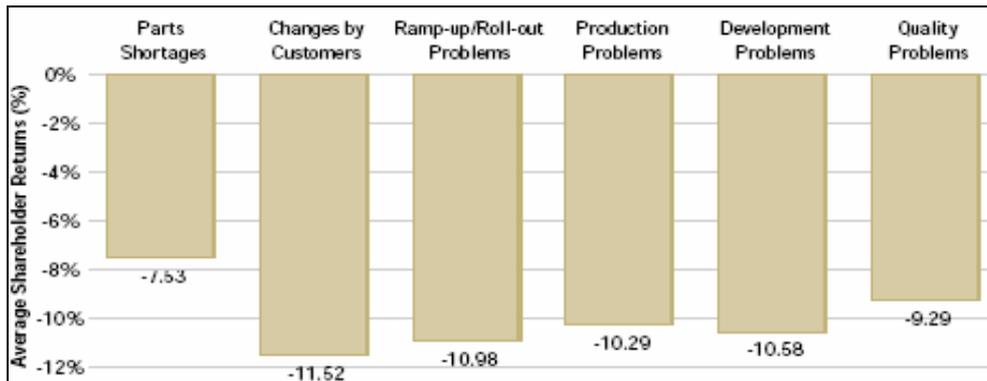
The survey revealed that collaboration in the area of “supply chain planning” and “linkages with customers and suppliers” is perceived to offer the greatest operational-improvement opportunities. Investment in these three capabilities can help companies respond more effectively to changing market conditions, proactively control costs, and tighten relationships through greater information sharing and collaboration.

The survey looked for the main problems in supply chains today (Figure 3-8). They span from changes by customers, to ramp up, and rollout problems, production problems, development problems, quality problems and parts shortages. Among those, the main focus for the next few years is predicted to be on (Anderson 2002, p. 27-29):

- The front-end of supply chain more than the back-end.

- Collaboration, which will become the most strategic capability.
- Divesting assets and functions not core to value delivery to specialists that can make more money on them.
- Improving service and support, as they will become as important as the product itself.
- Ability to integrate new and innovative capabilities within the corporate business models that will drive high levels of value creation.

Figure 3-8: Biggest Problems in Supply Chain that Impact Shareholder Value



Source: Anderson, 2002, p. 26

According to Cohen (2004, p. 165), the next generation of collaboration will focus on long term customer satisfaction. True integration among different systems will become reality allowing companies to monitor their production and logistic assets from a central system. Systems will be able to look ahead, predict unplanned events, and trigger the correct response as needed. Collaborating with multiple customers and suppliers will be the standard. Collaboration with material suppliers will continue to be transaction-focused. Collaboration will increasingly focus on the front-end of the supply chain, with emphasis on collaborative forecasting and replenishment models.

3.5. DESIGN OF MEASUREMENT SYSTEMS AND MEASUREMENTS

Whatever is measured has potential to improve. Thus, to be able to improve supply chain performance, a measurement system and measurements should be established. Measurement system and measurements must (Cohen, 2004, p. 187):

- Translate financial objectives and targets into effective measures of operational performance.
- Evaluate and translate the impact of operational performance on future earnings or sales.
- Drive behaviour across supply chain organization.

If we try to manage performance with metrics, they must be carefully designed, keeping in mind that metrics must have the following characteristics (Cohen, 2004, p. 188):

- They must be aligned with business strategy.
- They must be balanced and comprehensive; they need to take into account the financial dimension, internal dimension, customer dimension, and innovation and learning dimension.
- Targets must be set on both internal and external benchmarks.
- Targets must be achievable.
- Metrics must be highly visible and monitored at all levels of the company.
- They must be used as a continuous improvement tool.
- They must be implemented via a formal implementation plan.

Supply chain targets are often conflicting. Excellent service level costs money. Therefore, the measurement systems need to be a balance of (Kaplan, 1996, p. 12):

- Internally focused and customer facing metrics.
- Financial and non-financial metrics.
- Functional and cross-functional metrics.
- Metrics measuring innovation and continuous improvement.

Best-in-class companies are using balanced metrics that support their strategy. Examples of level 1 metrics are shown in Figure 3-9.

Figure 3-9: Supply Chain Metrics

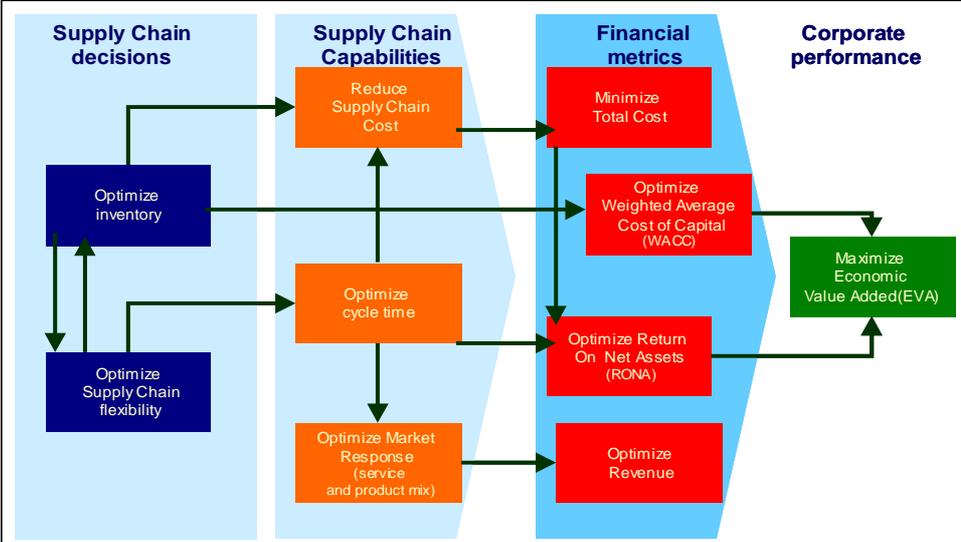
Performance attribute	Performance Attribute Definition	Level 1 Metrics
Supply Chain Delivery Reliability	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time	Delivery Performance
Supply Chain Responsiveness	The velocity at which a supply chain provides products to the customer	Order Fulfilment Lead Time
Supply Chain Flexibility	The agility of a supply chain in responding to market place changes to gain or maintain competitive advantage	Production Flexibility
Supply Chain Costs	The cost associated with operating the supply chain	Total Supply Chain Management cost
		Total Return Processing Cost
Supply Chain Asset Management Efficiency	The effectiveness of an organisation in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital	Cash to cash cycle time
		Inventory Days of Supply
		Net Assets Turns

Source: Cohen, 2004, p.280

Evaluation and translation of improved operational performance on future earnings or business result is very important to get commitment for implementing supply chain management principles. One of the approaches is explained further on.

Let's assume that the objective of the management is to increase shareholder wealth. To evaluate potential value that can be captured with supply chain optimisation, consider the challenges of a merger or acquisition. The challenge of rationalizing warehouses, distribution centres, and even production facilities is a decision in the supply chain flexibility area. Supply chain decisions related to optimisation of inventory and optimisation of supply chain flexibility, drive forward operational capabilities. Those have a high impact on corporate performance and results visible in financial metrics (Lewin, 2003, p. 6). The relation among them is shown also in Figure 3-10.

Figure 3-10: From Supply Chain Decision through Capabilities to Financial Results



Source: adapted by Lewin, 2003, p. 6

Let us start with defining corporate performance. Economic value added illustrates a measure of comprehensive corporate performance that is determined by the combination of financial metrics shown in red in Figure 3-10. In it simplest from, the formula for EVA[®] can be reduced as follows in Figure 3-11.

The numerator for RONA is profit, so RONA is heavily influenced by revenue and cost. Therefore, managing both revenue and costs is critical to overall performance.

Simplified total cost includes cost of goods sold (COGS = costs of inputs, adding value through the transformation process, and delivering the product/service), and sales and administrative costs.

The weighted cost of capital reduces to summing the product of the cost of each capital component and the portion of the total capital that each component comprises. WACC has two impacts. The first is its impact on income statement and cash flow. For example, interest on loans that provide funds to purchase inventory has to be paid. The second impact relates to the balance sheet. Since invested

capital comes from banks, bonds, and the equity on the market, having too much capital tied up in inventory may mean that the company must raise additional capital and pay a higher price for that capital instead of new investments or enhancement to operations.

Figure 3-11: Definition of EVA, RONA

$$EVA = \text{Return on Net Assets (RONA)} - \text{Weighted Average Cost of Capital (WACC)}$$

$$RONA = \text{Net operating Profit after Tax (NOPAT)} / \text{Net Assets}$$

NOPAT = Net sales – Operating Expenses and Taxes

$$WACC = E/V * Re + D/V * Rd * (1-Tc)^2$$

Where:

- Re = cost of equity*
- Rd = Cost of debt*
- E = the market value of the firm's equity*
- D = the market value of the firm's debt*
- V = E + D*
- E/V = percentage of financing that is equity*
- D/V = percentage of financing that is debt*
- Tc = the corporate tax rate*

Source: Lewin, 2003, p.7

If the key financial metrics for creating corporate value relate to cost, capital charges, consumption, and profitability, then the corporate capabilities or competences required to drive those metrics include controlling supply chain costs, managing supply chain cycle time, and optimising responsiveness to the marketplace.

The **first capability** of the companies is to **reduce supply chain cost**. These companies focus mainly on the following activities: procurement, transformation, and delivery. These activities may involve not only materials, but also services and data or information. Current information technology enables very close links between acquiring the order and the activity of fulfilling the order. But there are still costs that are traditionally not that obvious. Examples of such costs can be: suppliers will charge for the additional set ups they have due to changes in schedule, costs of poor quality, cost of poor schedule, inventory carrying costs. All the charges that are paid to store, move, insure, and pay taxes on inventory that is not selling are part of supply chain costs. The financial charges are part of weighted average cost of capital and inventory levels directly affect that.

The **second capability** is to **optimise operational cycle time**. Cycle time is defined as the time from when an order is received until the customer can be invoiced or charged. Cycle time can be broken into its components, including procurement, manufacturing, packing, distribution, and service. Gaining insight into the tradeoffs between economy of scale and rapid schedule changes can optimise cycle time. This

trade-off is often most dramatic in manufacturing, but also relevant in procurement, warehousing and transportation. Visibility into customers' requirements and providing visibility into requirements to suppliers help to reduce cycle time. The sooner that information regarding changes can be known, the more complete that information is, the more likely it is that members of supply chains and value network will be able to plan around these changes with the least impact on cost.

The **third capability** is **responding to the marketplace**. All companies are doing this. Every company must anticipate market requirements before they happen. Capital has to be allocated and suppliers identified. Planning of demand is a fact of business. Second, companies must develop a product and service bundle that will find paying customers in sufficient number at the price that yields an adequate margin. Third, responding to market place means being able to have the right product, in the right place, at the right time, at the right quality, for the right price. Finally, in circumstances where demand exceeds the ability of the company to meet every order on time, the product mix should be such that it meets corporate objectives, such as maximizing margin, satisfying most important customers, shipping the most products on time, satisfying most customer orders on time.

3.6. MOST COMMON BENEFITS, BARRIERS AND BRIDGES TO SUCCESSFUL SUPPLY CHAIN MANAGEMENT

As it was described in Subchapter 2.6, supply chain management initiatives contribute significantly to the result of the company, therefore implementation of those practices is crucial for the companies today. On the other hand, the implementation of those practices is also a very complicated process and requires a high degree of management commitment.

As Ducan (2001, p. 1-5) states, the process of developing a logistics strategy along the supply chain is a complex task, particularly in large, international organizations. Proposals for implementation of the strategy are likely to include changes in the organization structure of the company, in the physical infrastructure used to store and move the company's products, and in the IT systems used to manage the quotation-to-invoice business processes. The process of implementation is even more difficult, because it is concerned with making changes to the way people work, their reporting lines, and the systems they use to undertake their changed roles within the organization. Ducan suggests companies to follow six basic implementation rules. Following them, however, should minimize the impact of difficulties encountered during the process. After all, developing a strategy is a wasteful exercise if it is not successfully implemented. These six rules for successful implementation of a logistic

strategy can also be applied to implementation of supply chain management principles. They are (Duncan, 2001, p. 3):

- The commitment of all members of the senior management team prior to project start up should be obtained.
- Logistic performance measurement early in the implementation phase of the project should be introduced.
- The required level of implementation resources prior to the start of the project should be identified and obtained.
- Communication is key driver to success.
- IT systems should not be an excuse for not proceeding on other areas.
- Line management, not the project team, must be responsible for implementation.

The Centre of Advanced Purchasing Studies (Fawcett, 2003, p. 10) made a research of what the most common benefits, barriers, and bridges when implementing advanced supply chain practices are. The research was based on 52 interviews with carefully selected companies perceived by academia as the ones who do SCM well. The result of the survey shows (Figure 3-12), that most common benefits are related to increased responsiveness of the companies (external and internal), lower cost, better quality, and closer relationships with key partners.

Figure 3-12: Top Ten Benefits, Barriers, and Bridges to Supply Chain Management

Benefits	Barriers	Bridges
<ul style="list-style-type: none"> ▪ Increased customer responsiveness ▪ More consistent on-time delivery ▪ Shorter order fulfilment lead times ▪ Reduced inventory costs ▪ Better asset utilization ▪ Lower costs of purchased items ▪ Higher product quality ▪ Ability to handle unexpected events ▪ Faster product innovation ▪ Preferred & tailored relationships 	<ul style="list-style-type: none"> ▪ Inadequate information sharing ▪ Poor/conflicting measurement ▪ Inconsistent operating goals ▪ Organizational culture & structure ▪ Resistance to change – lack of trust ▪ Poor alliance management practices ▪ Lack of SC vision (understanding) ▪ Lack of managerial commitment ▪ Constrained resources ▪ No employee passion/empowerment 	<ul style="list-style-type: none"> ▪ Senior & functional managerial support ▪ Open & honest information sharing ▪ Accurate & comprehensive measures ▪ Trust bases, synergistic alliances ▪ Supply chain alignment & rationalization ▪ Cross-experienced managers ▪ Process documentation & ownership ▪ Supply chain education and training ▪ Use of supply chain advisory councils ▪ Effective use of pilot projects

Source: Fawcett, 2003, p. 12

The main barriers presented in the Figure 3-12 can be summarised into management and organisational issues within the organisation and with external partners. The most common bridges that can help overcome barriers are: senior and functional management support, open and honest information sharing, good measurement systems, process documentation, education and training, use of supply chain advisory council.

As explained in this chapter, there are numerous issues that need to be addressed in the company, before successful implementation of supply chain principles can take place. They span from choosing the right strategies aligned with business requirements to defining the critical processes that are needed for the execution of the strategy. Nothing can be implemented without the right people with the competences that are supporting development and execution of supply chain processes. An effective measurement system is also a prerequisite, because it provides good support for monitoring the operational performance. Last but not least, without open and honest collaboration between the parties in supply chain the benefits in terms of better cost, flexibility, and service level are difficult to achieve.

Due to all that, the implementation of the supply chain management is a very complex task. It requires very professional management of the organisations in supply chain and relationships between the partners in the supply chain. To be able to manage the complex changes related to implementation of advanced supply chain management principles in the supply chain, use of external advisory councils is often crucial to overcome all the barriers of the implementation.

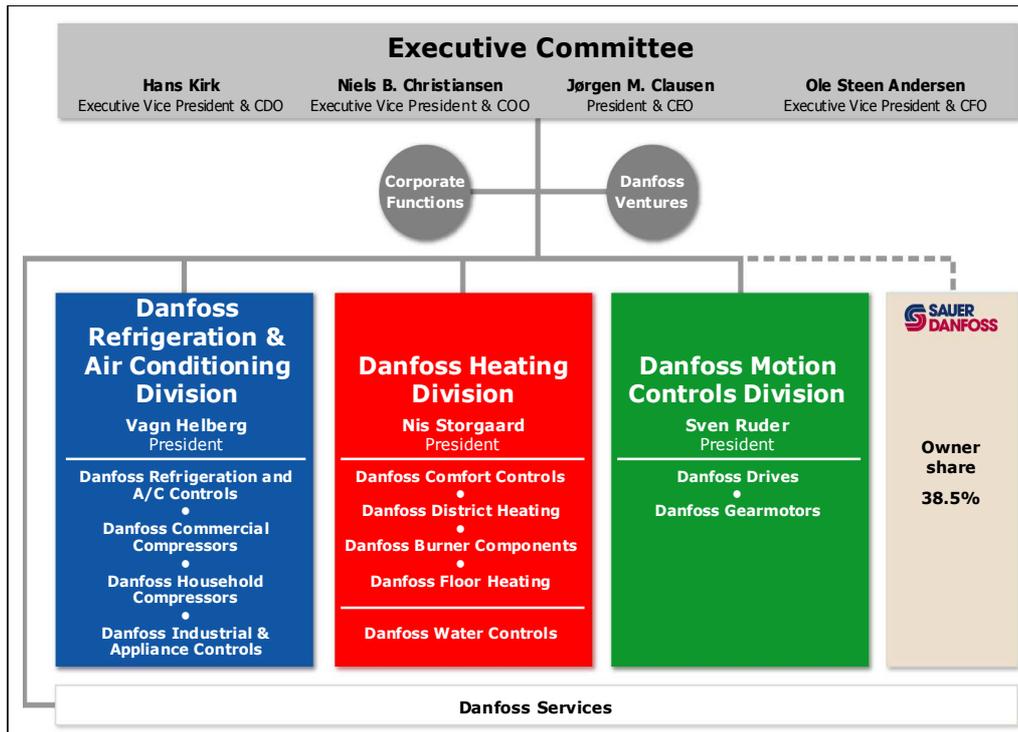
4. INTRODUCTION OF DANFOSS DISTRICT HEATING BUSINESS AREA

Danfoss District Heating Business Area has in the past five years implemented many good supply chain management principles that have contributed significantly to the business performance. However, there is still big potential for further improvements. In this chapter, DHBA is introduced and the level of supply chain maturity is shown.

4.1. INTRODUCTION OF DANFOSS GROUP

Danfoss is Denmark's largest industrial Group with an annual sales turnover in 2004 of 16,350 million DKK (2,200 million EUR) and has 17,543 employees worldwide (Danfoss Annual report, 2005). Danfoss is a family-owned, global company (no public shares, but approx. 1% employee shares). The Group has 59 production sites in 21 countries. Daily, they produce over 250,000 items. Danfoss sells products via 119 sales companies around the globe and 61 distributors. The Group is organized in three divisions: Refrigeration and Air conditioning, Heating, Motion controls. Each division has several business areas as shown in Figure 4-1.

Figure 4-1: Danfoss Divisions



Source: Danfoss intranet 2005

In 2004 the Refrigeration and Air-conditioning Division contributed around half of the turnover, 25% the Heating division and 20% the Motion control division. The Heating division achieved the greatest growth in year 2004. This was also due to a number of acquisitions within DHBA (Annual Report, Danfoss A/S, 2004).

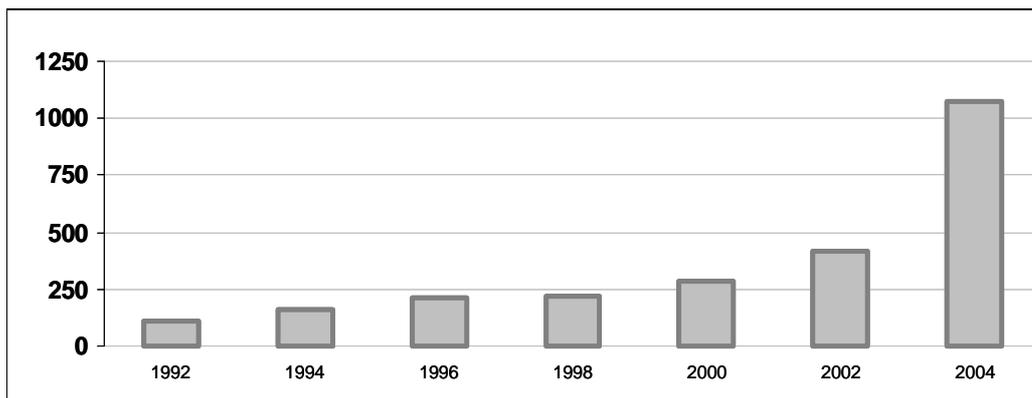
The Heating Division is further on split into seven business areas: Comfort Controls, District Heating, Burner Components, Floor Heating, Water Controls, North America and Asia Pacific. Each business area is responsible for all activities related to sales, marketing, manufacturing, and product development. Regional sales companies are responsible for marketing, sales, and customer service with highly qualified staff close to customers (Perspective for Heating Division, 2003, p.10-15). The scope of further investigation of this thesis is limited to District Heating Business Area

4.2. INTRODUCTION OF DISTRICT HEATING BUSINESS AREA

4.2.1. DHBA Business Development

Over the past eight years, DHBA has grown significantly in terms of turnover. From generating 280 million DKK (38 million EUR) in year 1996, the DHBA grew to 1,100 million DKK (150 million EUR) in year 2004. The growth is shown in Figure 4-2.

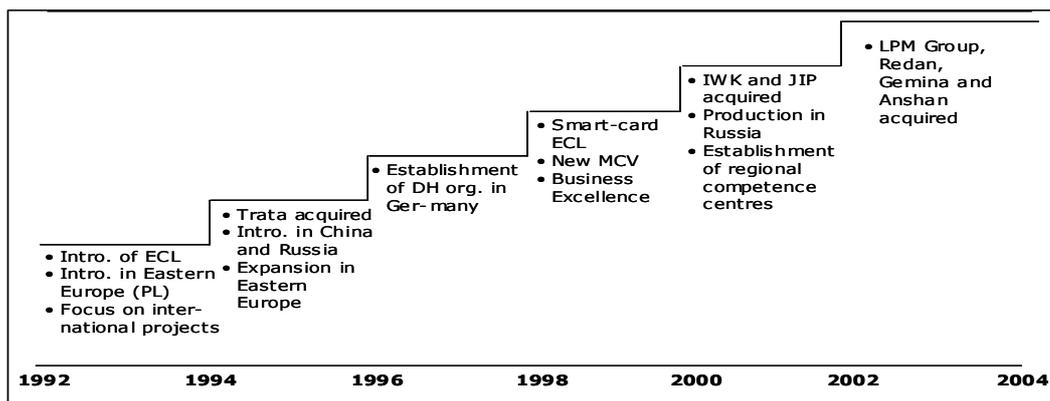
Figure 4-2: DHBA Turnover Growth in Million DKK



Source: Introduction to Danfoss District Heating, 2005, p. 5

The average growth of 21% in the period from 1992 to 2004 has been achieved through extension of product range, focusing on new markets and especially, in years 2002 to 2004, by acquiring new companies, presented in the Figure 4-3.

Figure 4-3: DHBA Main Milestones



Source: Introduction to Danfoss District Heating, 2005, p. 5

The main characteristic of DHBA is that a significant part of the business consists of public and commercial project business (tendering). On the other hand, it is also a very end-user-driven business. A big share of turnover represents sales to District Heating Work - DHW, consulting engineers, building and house owners and housing associations. The business is driven mainly by renovation activities and only partly on new constructions; due to that it highly depends on the level of investment in a certain country.

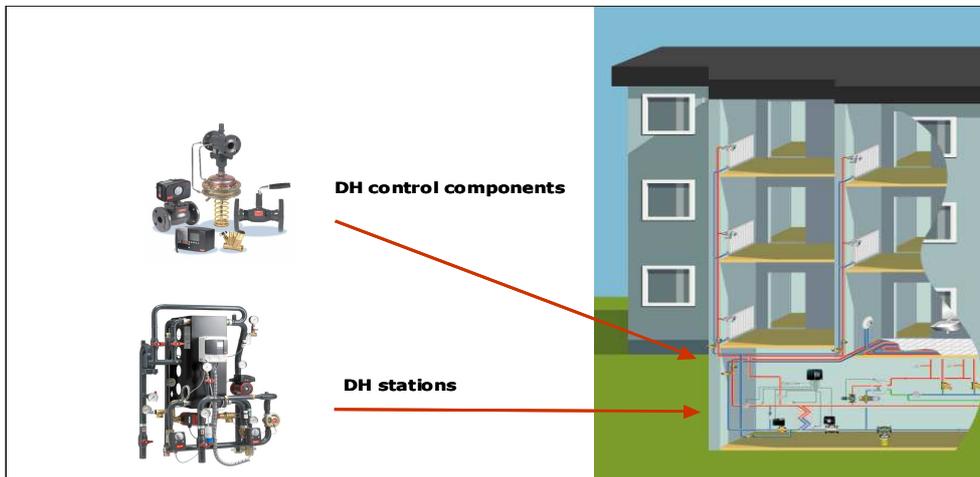
In terms of competitors, there are only three real global players next to Danfoss – Siemens, Alfa Laval and Samson – but many local small competitors in different countries (especially for sub stations).

4.2.2. Products and Markets

Technical requirements for different products are different from country to country. In some countries, requirements vary from DHW to DHW, resulting in a broad range of different products serving a single country. In general DHBA offers two main types of products shown also in Figure 4-4:

- A complete range of control components including self-acting pressure and temperature controls, electric weather compensators, motorized control valves, shut-off ball valves and heat meters, for built-in on site or for OEM's (Original Equipment Manufacturers) and
- A complete range of substations from the small-prefabricated ones to the large substations that can be fully adapted to customer requirements and are intended for fast installation – Built to Site (BTS).

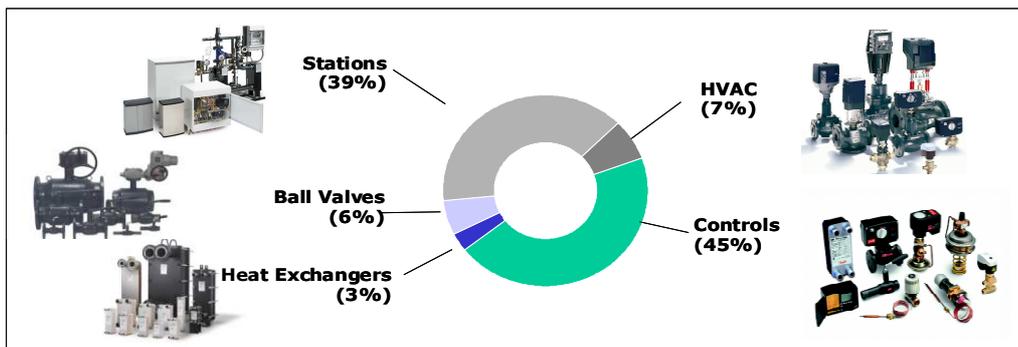
Figure 4-4: Two Main Types of Product Offerings



Source: *Introduction to Danfoss District Heating, 2005, p. 11*

The share of turnover per type of product is shown in the Figure 4-5. The main share is taken up by control components (45%), followed by stations (39%) and the rest (16%) are split among HVAC components, ball valves, and heat exchangers.

Figure 4-5: Share of Turnover per Product Types in 2004



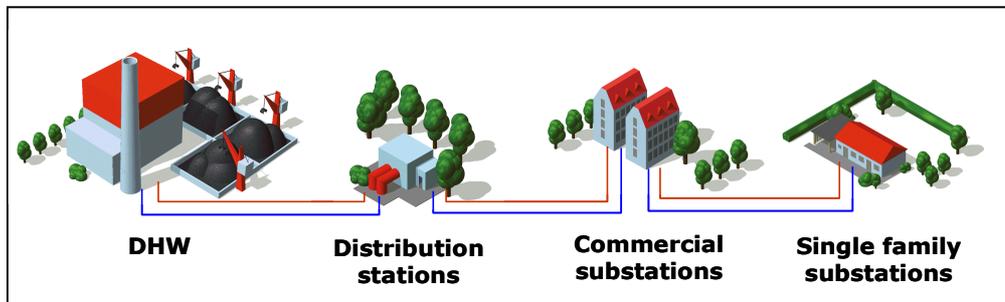
Source: *Introduction to Danfoss District Heating, 2005, p. 22*

There are two major markets on which DHBA is selling components and substation:

- The first one is the district heating market, where field components and substations are sold.
- The second is central heating and commercial HVAC applications market on which DHBA sells central heating and HVAC controls including self-acting pressure and temperature controllers, electronic heating controls and motorized control valves for central boiler controls, ventilation and air conditioning systems.

Products can be used in DH works or distribution stations, apartment blocks and commercial buildings, as well as family houses (Figure 4-6). Therefore they are sold through different distribution channels (district heating works, OEM, contractors, installers and wholesalers).

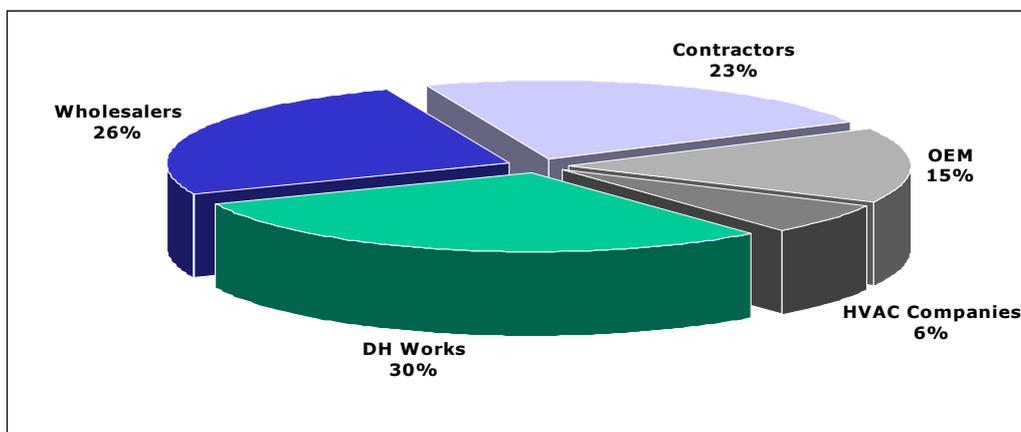
Figure 4-6: Main Product Applications



Source: Introduction to Danfoss District Heating, 2005, p. 1

The share of sales to different customer types in year 2004 is shown in Figure 4-7. The most significant customers are district heating plants (works) representing 30% of turnover in 2004, followed by wholesalers with 26% and different contractors with 23%. The remaining 21% is shared between OEM customers and HVAC companies. The bulk of the business are companies that require close cooperation to be able to fulfil the demands they have in terms of technical specification of products as well as supply chain requirements in terms of delivery times.

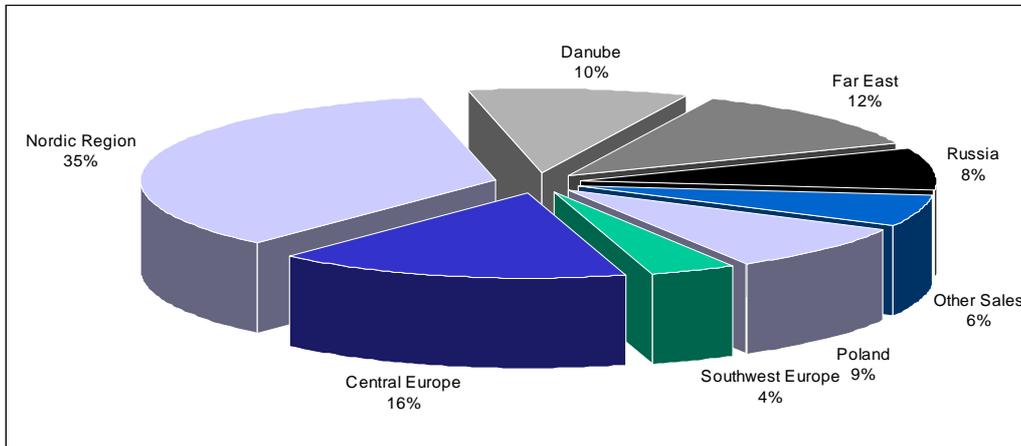
Figure 4-7: Share of Turnover per Customer Type in 2004



Source: Introduction to Danfoss District Heating, 2005, p. 23

As it can be seen from Figure 4-8, DHBA sells products all around the world, but the primary regions are still Europe where 74% of turnover is made (35% Nordic Region, 16 % Central Europe, 10% Danube Region, 9% Poland, and 4% South West region). Far East with 12%, and Russia with 8%, are the main emerging markets. The remaining markets represent 6% of turnover.

Figure 4-8: Share of Turnover per Regions

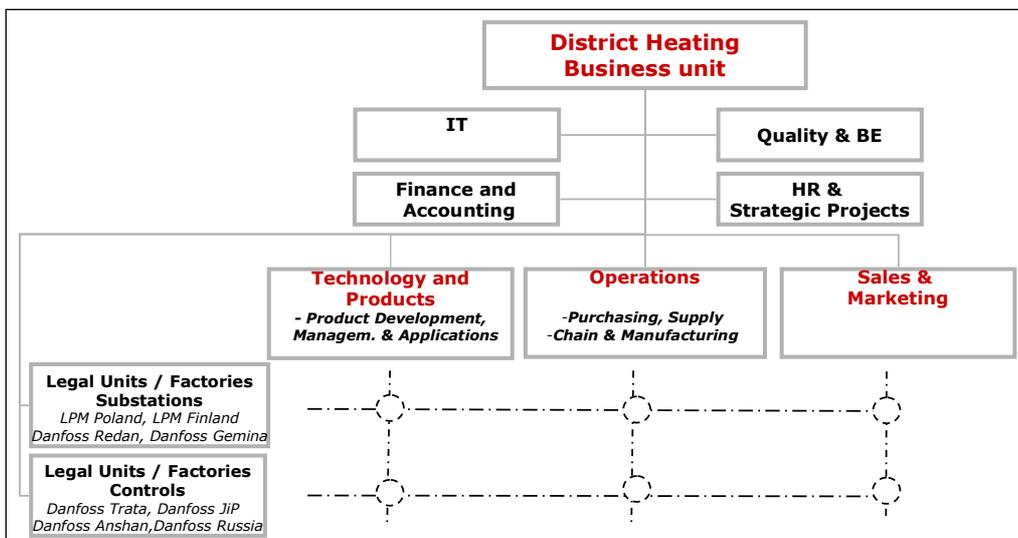


Source: Introduction to Danfoss District Heating, 2005, p. 21

4.2.3. Organization

DHBA is organized around core processes. In year 2002 organization was changed from traditional legal and functional organization into process organization based on three core processes: Sales and Marketing, Technology and Products, and Operations shown in Figure 4-9.

Figure 4-9: Organization of DHBA

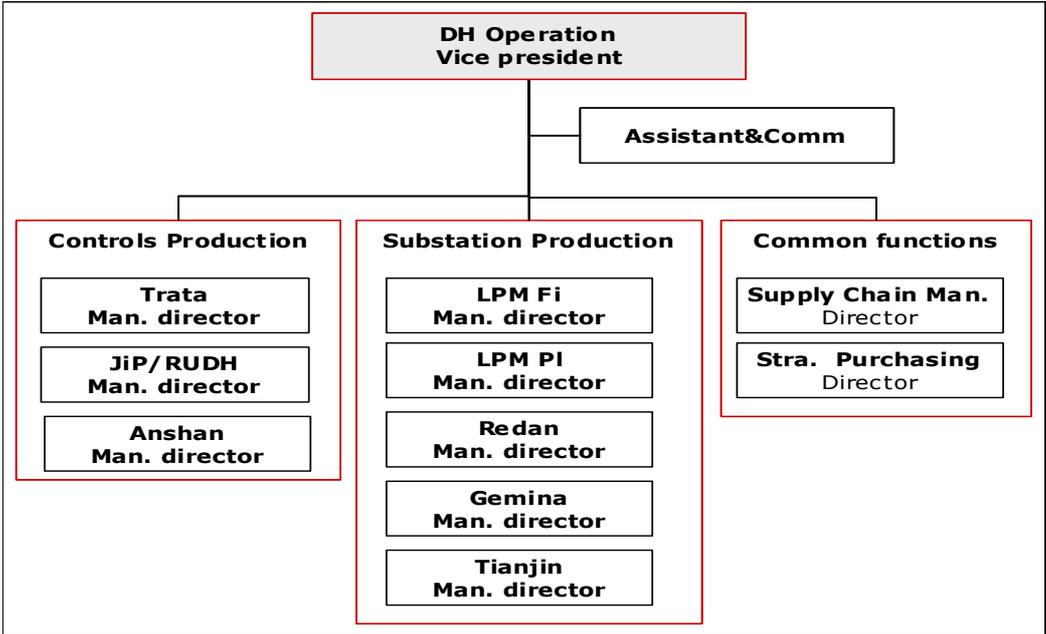


Source: Introduction to Danfoss District Heating, 2005, p. 2

The chief responsibility of Sales & Marketing is growth of sales through acquiring new companies, entering new markets and selling a broader product range. The main responsibility of Technology and Products is to assure an optimal product portfolio, by introducing new technologies and innovative products.

The responsibility of Operations is to assure good service level to customers at lowest cost, through synchronizing the flow through supply chain, improving efficiency in manufacturing and improved supplier base. The **Operations organization** is shown in Figure 4-10.

Figure 4-10: DH Operations Organization in 2005



Source: Introduction to Danfoss District Heating, 2005, p. 37

The roles in Operations are split around core processes: Purchasing, Manufacturing, Availability Management and Supply Chain Planning. Availability Management and Supply Chain Planning are joined into one function, called Supply Chain Management.

The processes are geographically organized differently:

- Local Manufacturing departments for each production unit.
- Purchasing and Supply Chain Management departments as more centralized functions.

The role of Purchasing is to manage optimal supplier portfolio, with the target of optimal material acquisition cost and a reliable and fast supply of materials.

The responsibility of manufacturing managers is to assure efficient production process despite big seasonality. To be able to do that the flexibility of workforce is one of the critical tasks.

The role of Supply Chain Management (Supply Chain Planning and Availability Management) is to balance aggregated demand with aggregated supply possibility. In other words: to plan the total flow of goods through the supply chain. This process encompasses finished goods, semi-finished goods, and raw materials. The purpose of planning is to be able to decide on the structure, organization, location, and capacity needed over time. By doing that all relevant value chain processes: procurement, manufacturing, warehousing & distribution, and customer service; can be aligned to the plans and can focus their efforts to achieve optimal performance.

Core supply chain processes are under the umbrella of Operations. Thus, Operations assures the coordinated management of supply chain, or as explained in Subchapter 2.2, functional and geographical integration of the organizations within supply chain. Supply Chain Planning, as a function is the one, which coordinates different activities from strategic to operational in time.

4.2.4. Vision

It is DHBA's vision to be a global leader within core businesses of district heating and central heating. The vision also includes the aim of 10-15% annual growth and leading cost position.

The main strategy of the DHBA is profitable growth in all product areas on all markets and with further acquisitions, supported by:

- Operations optimisation including purchasing.
- New innovative products.
- Supply chain integration and complexity reduction by utilizing advanced IT technologies.

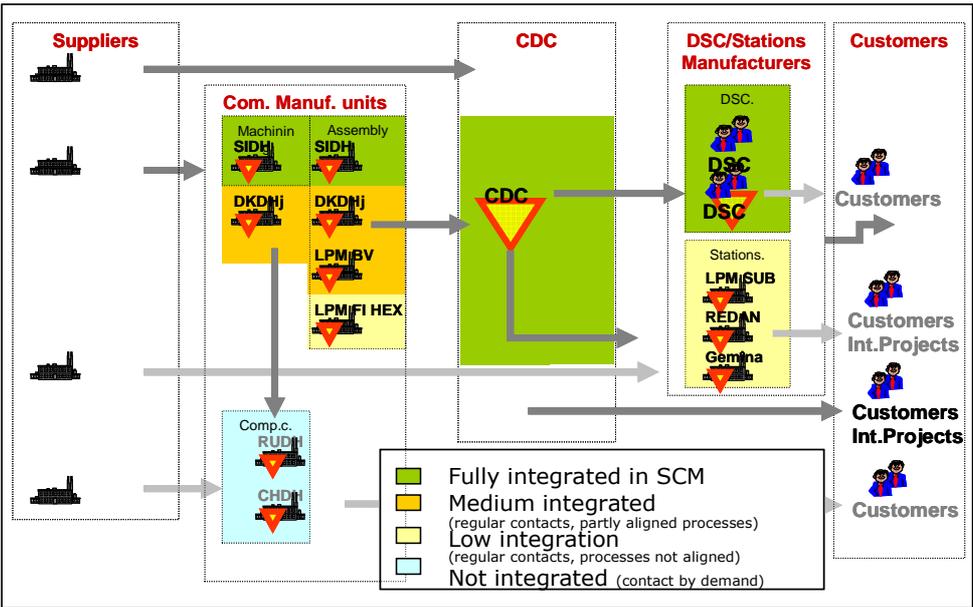
As we can see, the supply chain integration has an important role in overall business strategies. Integration of supply chain is very much seen as IT integration of processes and not that much as an integrated management of the supply chain. This would mean integrated planning, organizing, leading, and controlling of the entire supply chain. On the other hand, integrated management was one of the key components of implementing integrated supply chain in years 2001 and 2002. One important observation is also that operations optimisation and purchasing optimisation are mentioned separately even though suppliers and production units are a key element of integrated supply chain management. This can lead to the same

conclusion, as written above, that integrated supply chain means more IT integration of the processes and not integrated management of a whole supply chain.

4.3. DH SUPPLY CHAIN AND SCOPE OF FURTHER ANALYSIS

The Danfoss DHBA supply chain is relatively complex. Today the supply chain involves more than 900 suppliers supplying more than 7,000 materials to 8 manufacturing locations, one central distribution centre in Denmark and a few local or regional distribution centres (Russia, China, Danube as the main ones), and more than 25 Danfoss sales companies worldwide serving over 5,000 active customers and a few key accounts served directly from production units. In addition, there are also numerous logistic service providers. This complexity is a result of the significant growth of DHBA in recent years, mainly through acquisitions and growth in new markets. DHBA has acquired more than five high performing manufactures of substations and heat exchangers in the last two years and sales growth in China and Russia was above 30% in the same period. The result of acquisition strategy is also a unique but relatively broad product portfolio, including small, medium sized and large substations, heat exchangers, and automatic controls. DHBA offers more than 3,500 controls components worldwide and around 2,000 semi standard substations, and completely customized substations. The acquisitions have increased supply chain complexity in many areas and the acquisition integration is an ongoing process. The consequences of those acquisitions are mainly an increase in manufacturing locations (see also Figure 4-11), increased supply base and more complex planning and order management process.

Figure 4-11: Level of Integration in DH Supply Chain



Source: Author

In Figure 4-11 following abbreviations are used:

- *CDC - Central distribution centre in Denmark.*
- *CHDH – manufacturing location in China.*
- *DKDHJ - manufacturing location JiP Glamsbjerg, Denmark.*
- *DSC - Danfoss sales companies.*
- *LPM BV - manufacturing location LPM Poland, production of Ball valves.*
- *LPM FI HEX - manufacturing location LPM Finland, production of heat exchangers.*
- *LPM SUB – manufacturing of substations in Finland and Poland.*
- *SIDH - manufacturing location Danfoss Trata, Ljubljana, Slovenia.*
- *RUDH - manufacturing location in Russia.*

As the current supply chain is very fragmented, also the integration level of the companies inside DH supply chain differs. Companies that were part of DH operations in year 2001 when the supply chain project was started are much more integrated than the newly acquired companies. From the integration level point of view, it is obvious that the potential of adding value through supply chain integration is still very big. Further, I will focus on analysing the part of DHBA, which is marked green in Figure 4-11. Parts marked with green encompass: DSC, CDC, and SIDH. The reason for that is that this part of the supply chain was in scope of the project, which was running in years 2001 and 2002.

5. ANALYSIS OF DANFOSS DHBA SUPPLY CHAIN MANAGEMENT

5.1. WHY DHBA IS FOCUSING ON SUPPLY CHAIN MANAGEMENT

In year 2000, it was recognized by the DH management that there is significant **improvement potential on supply chain area**. Stock levels were high, service level was not sufficient, and there was no overall coordination of activities across the supply chain. As DHBA did not have the internal competences, the consulting company KPMG was hired, because of their broad experiences in the field of supply chain management. KPMG was engaged to analyse the supply chain and to help implement the necessary changes.

To focus efforts on the most critical part of DH, the scope of the project was defined as: suppliers to manufacturing units SIDH, and IWK; manufacturing units SIDH, and IWK, central distribution centre and Danfoss sales companies. Since the finish of the project (end of year 2002), a considerable number of changes has happened, from transferring IWK to Slovenia and merging it in SIDH, to acquiring several new companies (that are not part of the following analysis).

KPMG analyses conducted in 2001 showed that logistic costs as percentage of turnover were higher than best-in-class companies. The main drivers of higher cost were identified as follows:

- The supply chain was made up of five organizational units (suppliers, SIDH, DKDHH, DSC's and customers), who focus on optimisation of their own part of the supply chain, thus leading to sub-optimisation of the overall supply chain.
- The lead-time between the organizational units was based on traditions and not market requirements or "what could be done"; the result is long lead times and high levels of inventories.
- The organization was lacking direction both in terms of vision and in terms of a standardized performance measurement system; this has led to lack of focus as well as uncertainty regarding the overall performance.
- The objectives set for different organization units were conflicting and not coordinated. SIDH was measured on variable cost, thus seeking efficiencies and economies of scale on purchasing, while DKDH (CDC) was measured on inventory levels throughout the supply chain, something that requires frequent purchasing and manufacturing of small volumes.
- Products were travelling through too many layers/organizational units before finally reaching the customer. This created disturbances in the supply chain, expressed as "erratic" fluctuations in demand.

The aim of the project was to improve DH supply chain by designing a vision and implementing processes, concepts and strategies, as well as changing organization that will enable DH to meet customer requirements in the future and provide the foundation for increasing market share and turnover, which will lead to long term competitive advantage for DH.

5.2. DH SUPPLY CHAIN VISION AND STRATEGIES

In year 2001 as part of implementation of the "supply chain project" the **vision** of synchronized supply chain was established, with the objective to coordinate a customer order with production order as well as purchasing order with less than one week of inventory of finished products.

The **main strategies** needed to meet business targets such as reduction of costs and increase of service level were defined as:

- Cycle time reduction from suppliers to production units, from production units to distribution centres and from distribution centres to market,
- Increase flexibility by suppliers and in production,
- Increased reliability between partners in supply chain, to increase trust,
- Integrated planning process, to coordinate efforts across the supply chain.

The **main enablers** of a synchronized supply chain were also identified. There were four of them:

- IT integration: Advanced planning and scheduling (APS) system, to manage and optimise the supply chain from raw materials through to deliveries.
- Working with world class suppliers and logistic service providers and utilizing web ordering, EDI and VMI for integration of all parties in the supply chain.
- Fast distribution and replenishment: 48 hours internal lead time from customer order receipt through to manufacturing and distribution to regional stock points.
- Consolidation of warehouses in Europe.

*This **vision** cannot be found in any of the documents describing the vision of Operations who is the main owner of supply chain processes **today**. The vision of DH operations today is: excellent service level and the leading cost position, achieved by fully competent employees (DH Operations perspectives, 2005, p. 2). The vision itself is less concrete than the initial one in terms of how to achieve excellent service level. Due to that, organizations that are part of DH internal supply chain have a different understanding of how to achieve current vision. Therefore also coordination of efforts across supply chain is harder.*

Further, in this chapter, key supply chain strategies and key concepts to implement the vision are described and evaluated by main building blocks as defined by Cohen (manufacturing strategy, outsourcing strategy, channel strategy, customer service strategy, and asset network) more in detail.

5.2.1. Customer Service Strategy

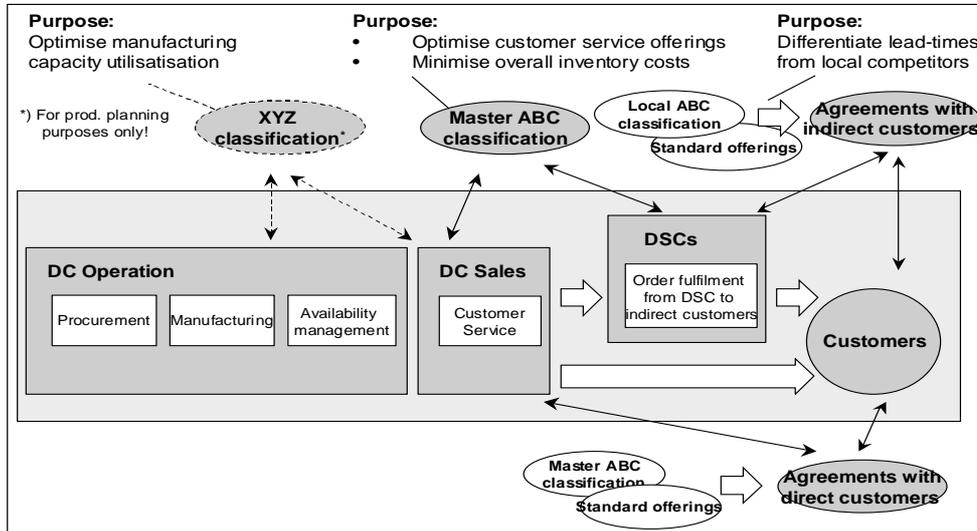
Customer service strategy is based on the **concept of order and customer relations' management** (shown in Figure 5-1). The main purpose of the concept is to differentiate from competitors on the market by standardizing customer offerings and offering better service level, both enabled by short and reliable internal lead times. Standardization of customer offerings is based on ABC classification of products.

The objectives of ABC classification are: to maximize service offerings to the customers and to minimize overall inventory costs. In that way the Master ABC classification defines:

- The lead times to end customers: A products to be delivered within 2 working days; B products to be delivered within 2 weeks; C products to be delivered within 6 weeks after receipt of customer order.

- The response times to DSC's: A and B products to be shipped within 1 working day; C products to be shipped within 4 weeks after receipt of order from Danfoss sales company.

Figure 5-1: Concept of Order and Customer Relations' Management



Source: KPMG final report, 2002, p. 24

The ABC classification was owned and maintained by DH Sales, based on commercial product characteristics, like a product's strategic importance and competitive offerings, defining basic offerings to the customers (Table 5-1).

Table 5-1: Customer Offerings

	Basic offerings	Additional offerings
Product requirements ("What to order")	<ul style="list-style-type: none"> • Define existing products which fit customer needs 	<ul style="list-style-type: none"> • Customize products • Customize packing • Customize labeling
Order placement ("How to order")	<ul style="list-style-type: none"> • Written purchase order • Electronic orders • Dedicated contract person or anonymous order desk • Language spoken by contact person or order desk • Order confirmations within 24 hours 	<ul style="list-style-type: none"> • Order via DSC (HVAC) • Supply on demand for example based on KAN-BAN or stock data
Delivery characteristic ("When to get it")	<ul style="list-style-type: none"> • Deliver products according to lead times associated with ABC classification • Delivered as promised (confirmed) • Proactive response toward customer order in case of delivery date can not be met due to operational problems • Regular service performance report send 	<ul style="list-style-type: none"> • Delivery of products with shorter lead times than according to ABC classification
Order delivery ("How to get it")	<ul style="list-style-type: none"> • Direct delivery from factory ("ex works") • Standard packing: single pack, multi pack, industry pack • Shipping entire order completely or separate 	<ul style="list-style-type: none"> • Transport organized to delivery location • Delivery direct to site • Customized packing for some Key accounts • Customized product • Customized labeling (KAN- BAN labels)

Source: KPMG, Final Report, 2001, p.27

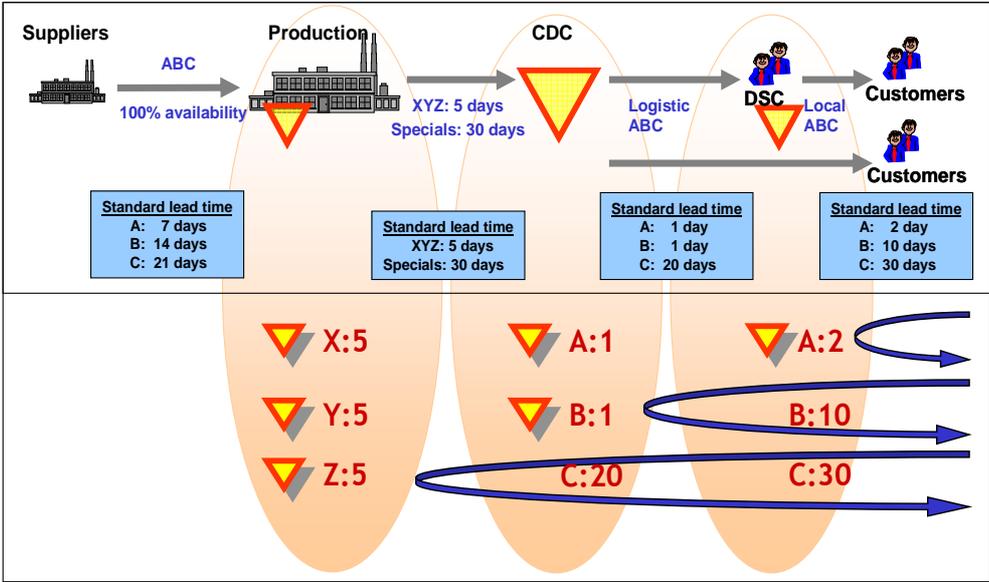
In addition to basic offerings, also additional offerings in the form of special agreements with indirect and direct customers were defined. These were to be offered only to a limited number of customers of strategic importance and/or additional fees might be charged for these offerings. Before additional offerings are agreed with a customer, internal agreement is necessary, to evaluate the consequences and feasibility with respect to the supply chain (see Figure 5-1).

Customer service strategy today is still based on the same concept. But during the last years overall customer requirements were not systematically revised, even though close contacts to customers were established and some advanced models of collaboration with customers implemented (such as VMI with one direct customer). ABC classification, as the base for standard offerings, is systematically reviewed on a yearly basis or at the time of new product introductions, with close cooperation with Sales.

5.2.2. Manufacturing Strategy

In manufacturing the **make to order strategy** was implemented, which is a good combination of make to stock, assemble to order and produce to order strategies. A and B products are made to stock and C products are either assembled to order or produced to order depending on decoupling point shown in Figure 5-2.

Figure 5-2: Make to Order Manufacturing Strategy

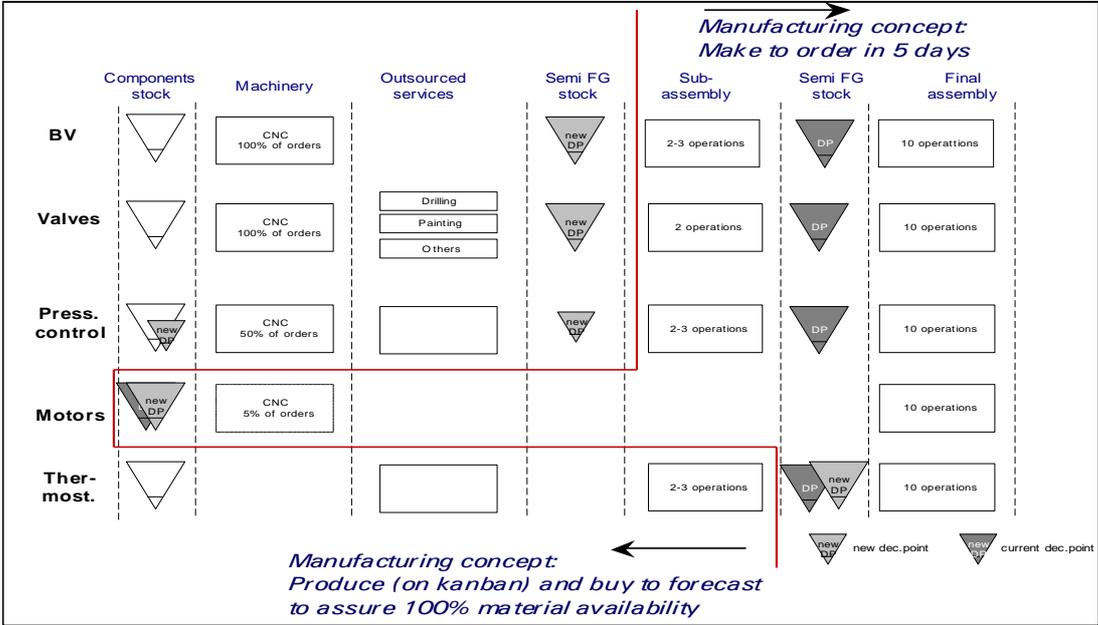


Source: SCM strategy 2005, p. 10

Decoupling points decouple customer order from production order (see Figure 5-3). The concept of decoupling points was introduced with the aim to facilitate short throughput time by assuming that materials are available. For example, the decoupling point for

the Motors product group is set on raw materials, which implies that when an order is received, each motor will be produced from raw materials stocked in production within a very short time. On the other hand, the decoupling point for Thermostats is set on semi finished products to be able to produce them within short throughput time.

Figure 5-3: Manufacturing Concept of Decoupling Points



Source: KPMG, Final report, 2001, p.32

In addition to decoupling points, five days lead-time was implemented. It is based on a five days timeline, where on the first day the order is received from customer or Availability Management and entered in Production Planning. The second day materials are prepared for production as a part of assembly process. On the third day physical assembly takes place. On the fourth day materials are ready in stock to be picked and packed and on the fifth day products are ready for distribution (see Figure 5-4).

Figure 5-4: Daily Planning Concept

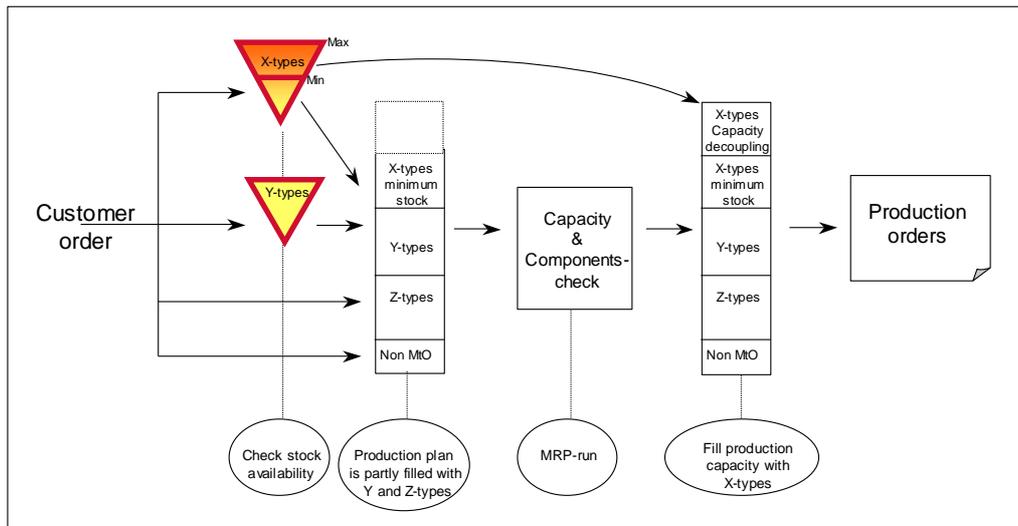
Day 1	Day 2	Day 3	Day 4	Day 5
Order entry Production planning	Assembly	Assembly	Handling	Distribution

Timeline in a 5 days lead time

Source: KPMG, Final report, 2001, p.32

To avoid daily fluctuations of demand in production, XYZ -classification per capacity (assembly) group was implemented. High movers (X-types) are produced to stock on days of low demand (Figure 5-5).

Figure 5-5: XYZ Concept for Daily Balancing of Capacities



Source: KPMG, Final report, 2001, p.33

This manufacturing strategy was fully implemented in 2002. Later on, improvements in terms of even further reduction of lead times were not conducted, despite the fact that the activities in this direction were planned. One of the reasons that the lead-time was not further reduced can also be found in the fact that manufacturing management has been changed two times since 2002. The consequence of not focusing on further lead time reduction is that the targets in terms of finished products stock reduction were not met.

5.2.3. Outsourcing Strategy

In the preliminary phase of the project in 2001 also outsourcing possibilities were examined. Outsourcing of operational and tactical supply chain activities would enable DHBA to focus on activities, which are really important for meeting customer requirements.

Thus, as a part of the project, also ideas for outsourcing were identified. They were grouped depending on the area where activities are conducted in: manufacturing, logistic and procurement. On the other hand, criteria for outsourcing were grouped into: make or buy possibilities, core competences of external partners, synergies, and skills with other company. Examples of possible outsourcing strategies are stated in Figure 5-6.

Already during the implementation of the supply chain project, those possibilities were only partly explored, and later on some activities were carried through, mainly on logistic and procurement area, based on make or buy criteria.

Figure 5-6: Outsourcing Concept

Criteria for outsourcing			
	Make or buy analysis	Core competence of external partners	Synergies in skills by outsourcing
Manufacturing	Accessories Filter Valves	Manufacturing of thermostats Machining	Manufacturing alliance with other company
Logistics	Warehousing Transportation	Inventory management for finished goods	4th party logistics: Virtual inventory Inventory ownership Network optimisation
Procurement	Procurement of parts which are not in BOM (tools, transport packaging) and fix materials	Inventory management for raw materials	4th party logistics: Outsourcing of procurement, inbound flow and contract negotiations
	Operational activities	Tactical activities	Strategic activities

Source: KPMG report, 2000, p.42

In-sourcing of warehousing and VMI concept for tools in production are an example of such activities. Outsourcing of tactical activities based on core competences of external partners were not implemented (for example VMI for raw materials) as the level of competence by suppliers was not sufficient. Outsourcing of strategic activities has not been considered so far. In the future, further optimisation of supply chain efforts can be explored in this area.

5.2.4. Purchasing Strategy

The general purchasing strategy is to ensure optimal managing of suppliers base, in the way that ensures control, follow up and reallocation of suppliers when needed. The purpose of such development is to avoid:

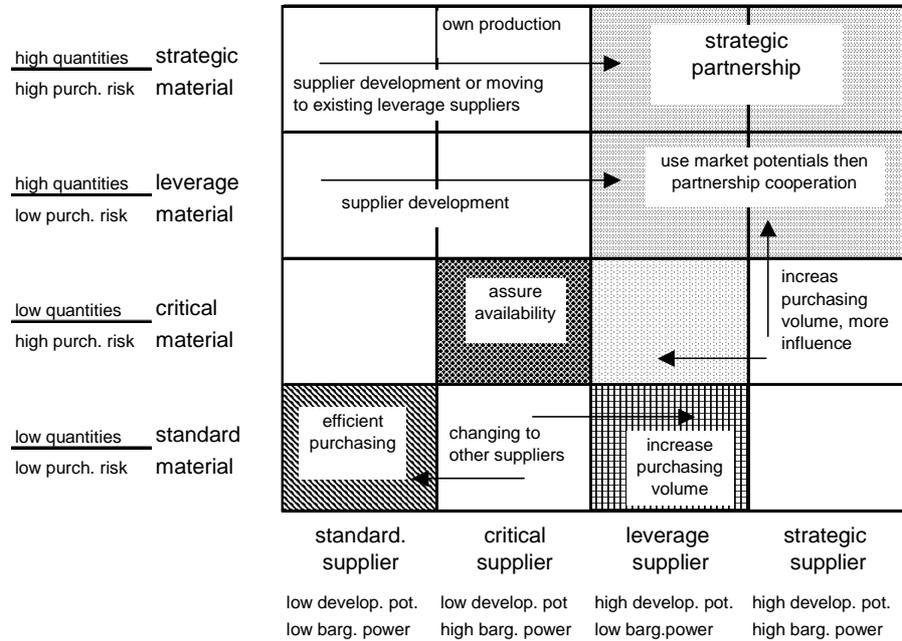
- Too high dependence on certain supplier.
- Lack of materials due to changes on supply market.
- Increase of prices and non-quality.

As the managing of supply base is a relatively complex task, systematic approach for selection of appropriate strategies for certain combinations of materials and suppliers is needed.

In the portfolio matrix of suppliers and materials the key factors influencing supply risk are stated. The factors are: time needed to change supplier, available capacities on the market, lead-time. Depending on those factors, suppliers are grouped as

shown in figure 5-7. The matrix in that way describes what kind of relationship or collaboration model needs to be developed with suppliers, depending on strategic importance of materials and suppliers.

Figure 5-7: Portfolio Matrix of Suppliers and Materials



Source: Purchasing Budget 2003, p. 6.

If we look from the supply chain perspective, the use of advanced supply chain practices is greater, moving from left bottom corner to top right corner, where advanced partnership models with suppliers such as VMI, and joined product development activities can be implemented with suppliers.

As the complexity of the supplier base is increasing, cost in supply chain in terms of managing suppliers as well as logistics costs also increase. One of the main strategies is reduction of the supplier base and sourcing from cost competitive countries.

In DHBA purchasing strategies are well documented. The use of advanced collaboration models with suppliers, such as VMI, has been clearly defined as the strategy for a very long time. But unfortunately, even today there are not many examples of successful implementation. This, on the other hand, also has an impact on the logistic cost in DH supply chain and especially on stock and service level.

5.2.5. Infrastructure

Infrastructure is divided in three areas: manufacturing infrastructure, logistic infrastructure, and information technology infrastructure.

Manufacturing infrastructure was designed as a set of two manufacturing plants where SIDH had also outsourced warehousing to external logistic provider close to the plant. Both manufacturing units were delivering most of the products to the central distribution centre in Denmark and from there on to main DSC and further to the market.

Logistic infrastructure – The main distribution centre is located in Denmark, where consolidation of the products also with other Danfoss business units takes place. From there, products are delivered to main local stocks and further on to the customers.

Information technology infrastructure - companies in DHBA supply chain were operating on the base of different SAP systems. There were some EDI connections between different locations but they were not creating visibility needed for integrated supply chain management. So the aim from the beginning was that migration into one SAP system is crucial to achieve the vision of a synchronized supply chain. One SAP should enable better planning, visibility, and the connection between the links of the DH supply chain. Advanced solutions such as APS (Advanced Planning and Scheduling) should enable faster response time to the customers. Improved use of different tools (dynamic stock, improved data accuracy, capacity planning) can improve process efficiency.

*The **actual situation today** is that in terms of Manufacturing infrastructure the IWK plant was closed down with the result of a positive effect on administration costs, where as transportation and lead time from suppliers of raw materials has increased with the effect of a negative impact on stock. But there are no firm plans as to what and how to improve the existing infrastructure in relation to the newly acquired companies.*

An additional change was also made as the warehousing activities were actually in-sourced, which has required significant investment in IT development as well as an increase of administration costs.

Optimisation of logistic infrastructure, in the direction of reducing local warehouses is progressing slower than expected. The main reason for that is that the Euro-lands project (the project of reducing the amount of local warehouses in Europe to one or three), driven by corporate functions, is delayed for two years. That has, on the one hand delayed expected stock reductions, but on the other hand, the end result will be greater as the goal of the project has become more ambitious. This means that all warehouses in Europe will be consolidated in the Central distribution centre in Denmark for most of Europe.

In terms of information technology, DH has implemented one SAP, but only in SIDH and CDC. Danfoss sales companies (DSC's), on the other hand still operate in another SAP, which is integrated to DH SAP on the base of VMI principle. This infrastructure is the cause for APS not being implemented, which means that order flow through systems requires longer time, and transparency of data and validity of order confirmations is poorer. Current plans are that with an upgrade of the system also this problem will be solved in 2006. It is also important to point out at this stage, that there are no firm plans how to improve IT infrastructure in relation to the newly acquired companies, as they are all running the business on very different IT infrastructures today.

The complexity of infrastructure has a great impact on the complexity of supply chain processes, therefore future efforts should focus on reducing infrastructure complexity to be able to simplify supply chain processes and in that way reduce supply chain management costs.

From the analysis of key components of good supply chain strategy we can conclude that all building blocks, as defined by Cohen (2004, p. 18) are present in the supply chain strategy today, but they have not been revised and structured in one document after year 2002. Due to that, also deployment and understanding of these strategies could be on a higher level. Separate functions are aware of their own strategies, but the overall understanding is missing.

There is also no clear ownership of outsourcing strategies as well as network optimisation strategies, which are thus not developed enough, even though they have great impact on overall efficiency of supply chain.

5.3. PROCESSES AND COLLABORATION MODEL

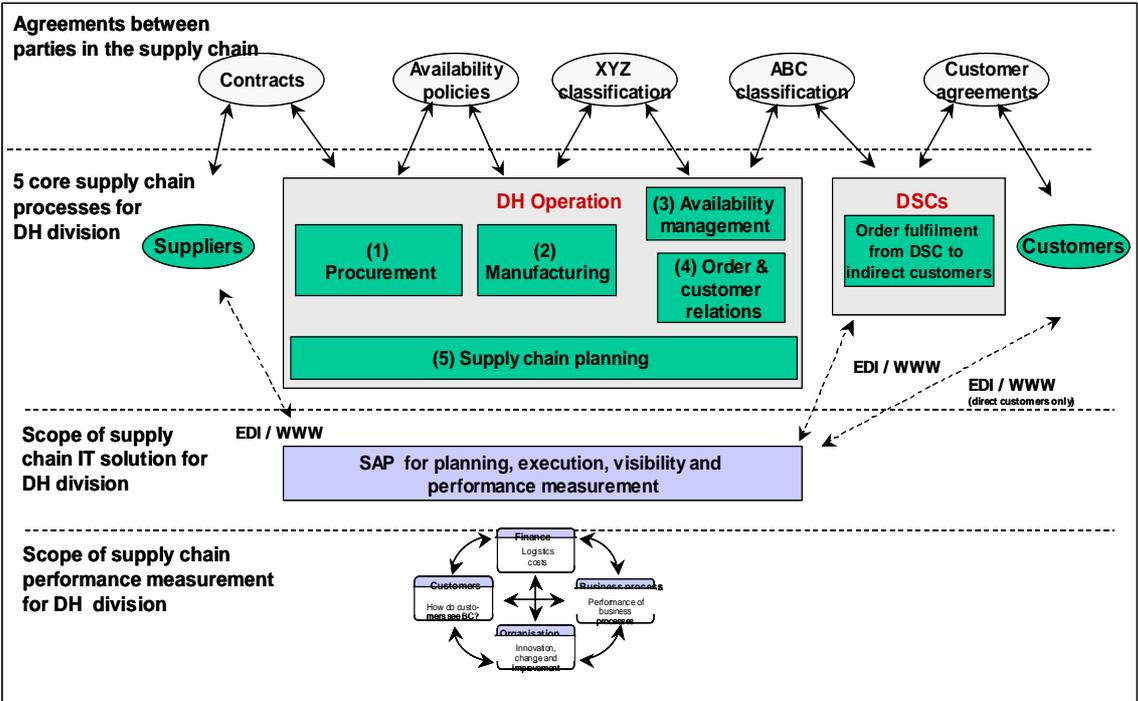
One of the key building blocks of implementation of supply chain management principles is also **implementation of processes and collaboration model** with other parties in the supply chain.

Based on benchmark of best performing companies and KPMG best practices a supply chain process model with five core processes was implemented. Those processes are: order and customer relations management (OCRM), supply chain planning, availability management, manufacturing, and procurement (see Figure 5-8). They are very similar to the processes defined by the SCOR model. The main difference is that processes defined by the SCOR model describe a delivery process from order intake to delivery, while in DH supply chain process model this is split in

two parts. The order and customer relation part is performed in DSC, and belongs to Sales; and the availability management part, which takes care that the order is successfully executed after being received. The DH supply chain process model focuses more on total order fulfilment, due to distribution layers (delivering products to central distribution centre and further on to local stock in DSC).

To assure good cooperation among processes within the supply chain, clear agreements between the parties were defined: contracts with suppliers, availability rules between Purchasing and Manufacturing, XYZ classification between Manufacturing and Availability Management, ABC classification between Availability Management and Order and Customer Relations function, as well as agreements with customers.

Figure 5-8: Integrated Supply Chain Model: Process and Collaboration Aspect

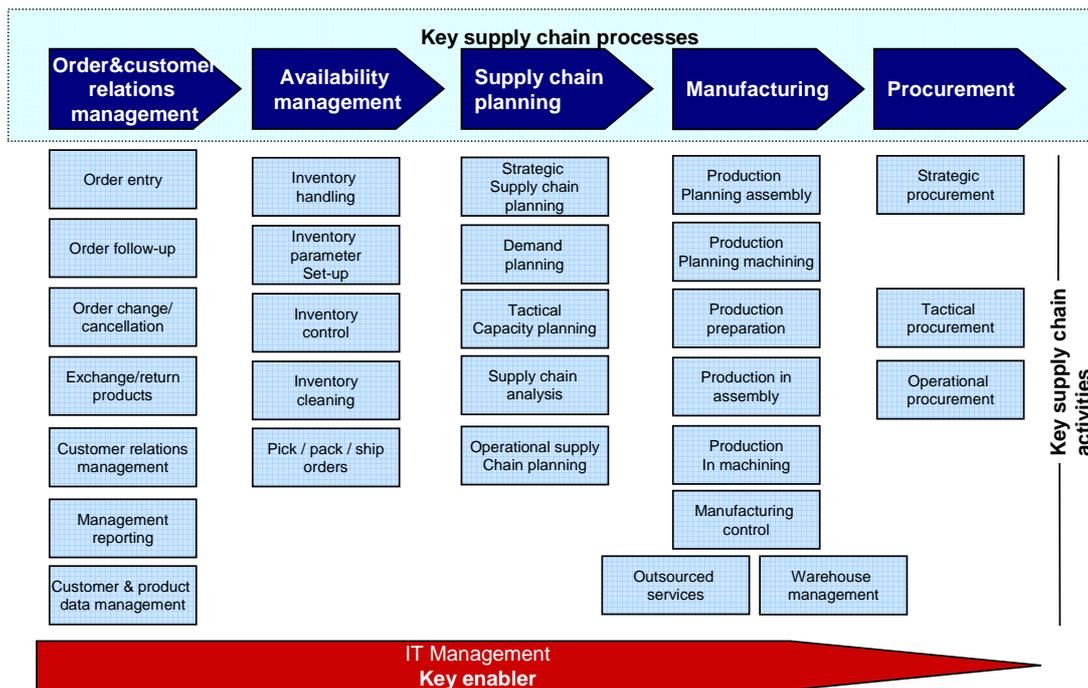


Source: KPMG, Final report, 2001, p. 21

One of the key drivers of efficient collaboration within the processes in internal supply chain is the implementation of one SAP, as well as the implementation of advanced collaboration models such as web or EDI, and VMI concepts towards customers and suppliers. Here, it is also possible to see that efficiency of integrated supply chain processes is heavily dependant on information technology. The main areas of IT integration and collaboration are shown in Figure 5-8.

All core processes such as procurement, manufacturing, availability management, supply chain planning and order and customer relationship management, were further divided into sub processes as shown in Figure 5-9.

Figure 5-9: Core DH Supply Chain Processes Divided in Sub-Processes



Source: SCM from Strategy to Implementation, 2003, p. 16.

Those processes are today more or less implemented, but generally, in the last few years DHBA lacks the systematic approach to documenting and mapping processes to carry out key supply chain activities.

Misunderstanding the role of agreements between processes caused, that some agreements has ended as update processes in Supply Chain Planning. Examples of such processes are update of ABC classification and XYZ classification. As a result the main purpose of these agreements, which is to clarify responsibilities among processes, is not fulfilled and the ownership of the processes that are very influenced by those agreements is not clear enough.

Further efforts should focus on improving understanding of agreements between supply chain processes as well as a more systematic design of sub-processes, focusing on key activities that they need to carry through. To be able to maintain the knowledge, processes need to be also systematically documented and reviewed.

5.4. MANAGEMENT AND ORGANISATION

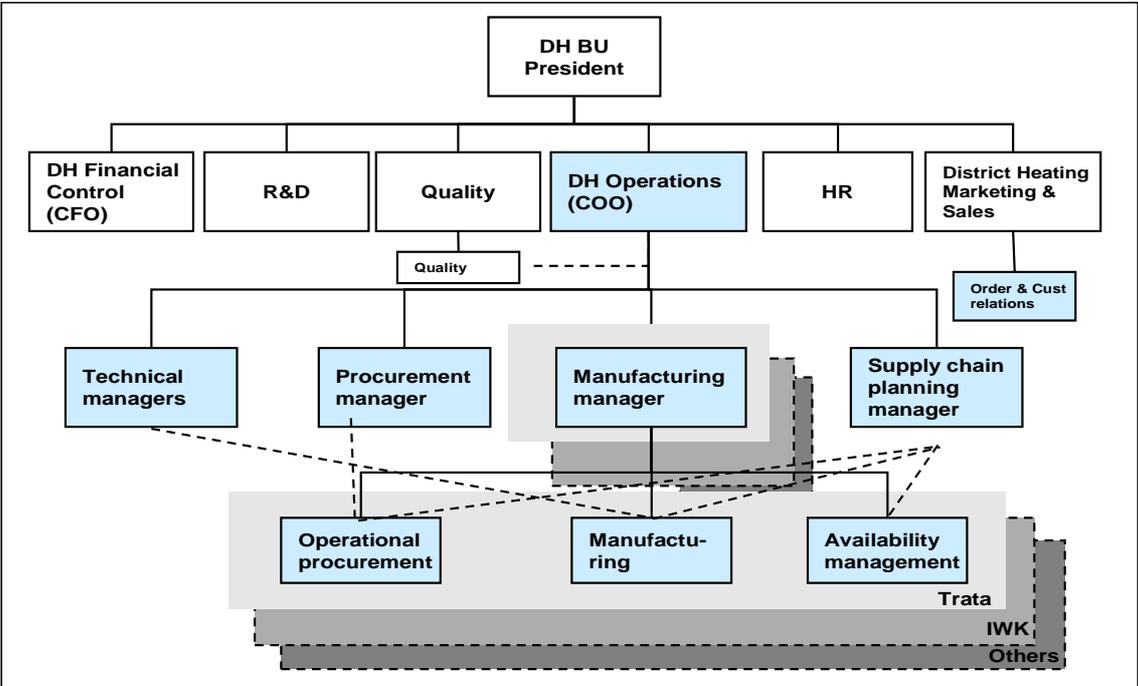
Designing the right organisation was a task that required a considerable change management effort. To be able to design an integrated organization, which would be able to manage supply chain processes across traditional boundaries of legal units, new functions were created, and many of the jobs have changed. The organisation

model implemented in 2002 was designed as shown in Figure 5-10. The model was based on KPMG experience and benchmarks.

The most important new function was DH Operations Vice president, put in charge of all processes in supply chain except order and customer relations, which are part of Sales. This change enabled functional integration of all activities across the supply chain under one management, no matter where the activities are performed, i.e. irrelevant of the geographical location of the functions performing those activities.

According to Cohen (2004, p. 110), this type of organization is a transitional organization, since customer order management process is not part of an integrated supply chain manager’s responsibility.

Figure 5-10: Management and Organization Model

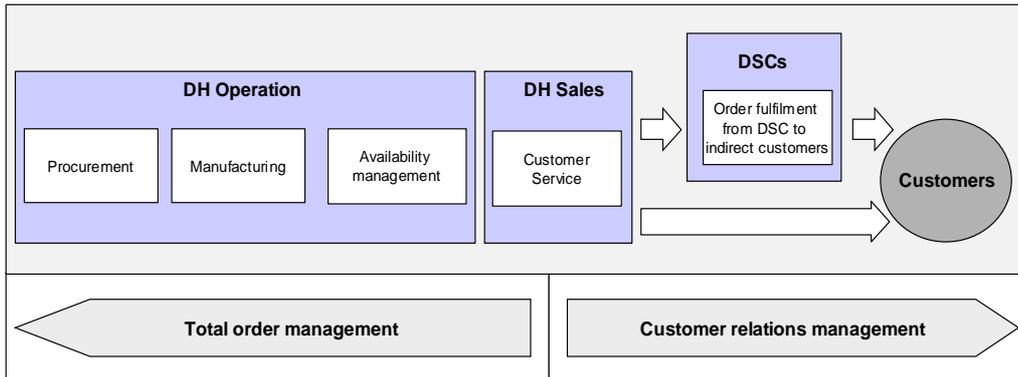


Source: KPMG, Final report, 2001, p. 37

The change was made also on the base of “total order management concept” shown in Figure 5-11, where total order management concept spans from receiving customer order, validating and authorizing the order, and initiates all necessary activities for order follow-up.

This is a logistic oriented role of customer service. “The customer relations management” on the other hand, builds relations with customers by providing information and assisting customers in a pro-active manner. This sales-oriented role of customer service remained part of Sales.

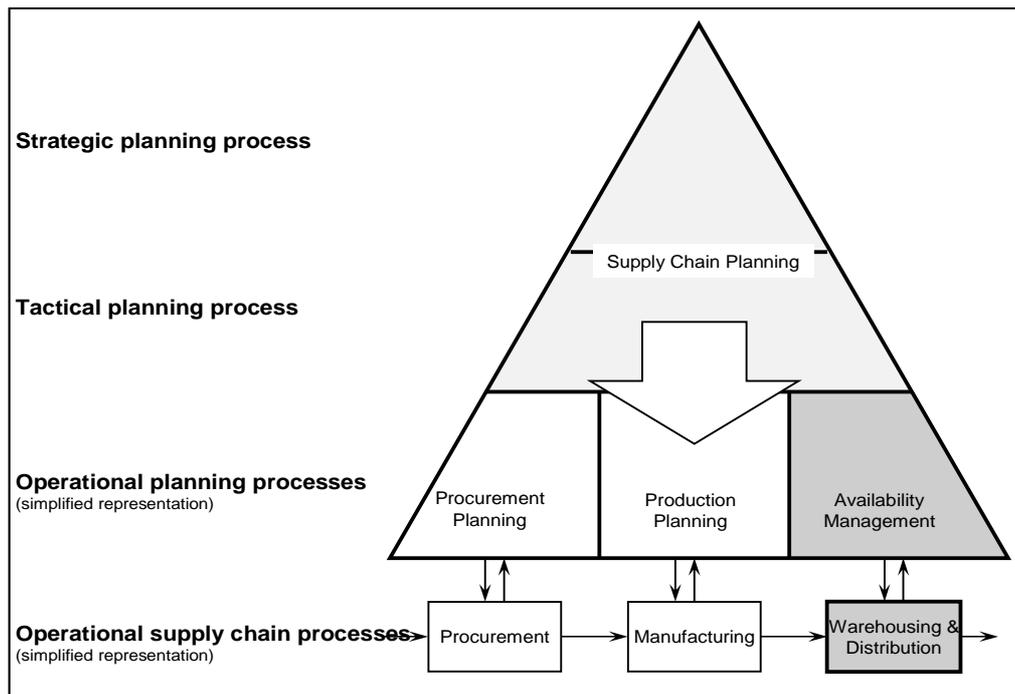
Figure 5-11: Total Order Management Concept



Source: KPMG, Final report, 2001, p. 24

Additional change came about with the introduction of two new functions: Supply Chain Planning and Availability Management. The concept of supply chain planning is shown in Figure 5-12.

Figure 5-12: Supply Chain Planning Concept – Different Levels of Planning

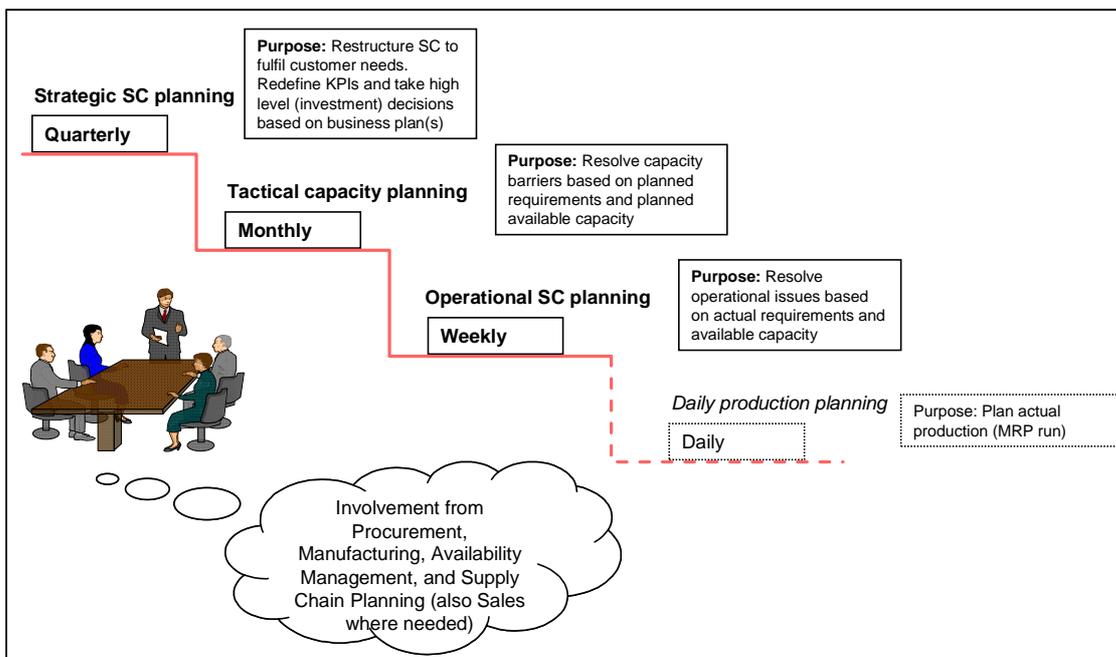


Source: KPMG, Final report, 2001, p. 29

The role of **Supply Chain Planning** is to plan the total flow of goods through the supply chain, in terms of finished goods, semi-finished goods, and raw materials. The purpose of planning is to be able to decide on the supply chain structure, organization, location, and capacity needed over time. By doing that, all relevant value chain processes: procurement, manufacturing, warehousing & distribution, and customer service, can be aligned to the plans and can focus their efforts to achieve

optimal performance. Another dimension of Supply Chain Planning is alignment of decisions and activities in time, between internal members of the supply chain as well as alignment of decisions with external functions such as Sales to agree sales plans and basic customer offerings, and with Product Management, especially with respect to phase in & out products. To perform those tasks well, teamwork and close cooperation are key success factors (see Figure 5-13).

Figure 5-13: Supply Chain Planning in Time Perspective



Source: KPMG, Final report, 2001, p. 30

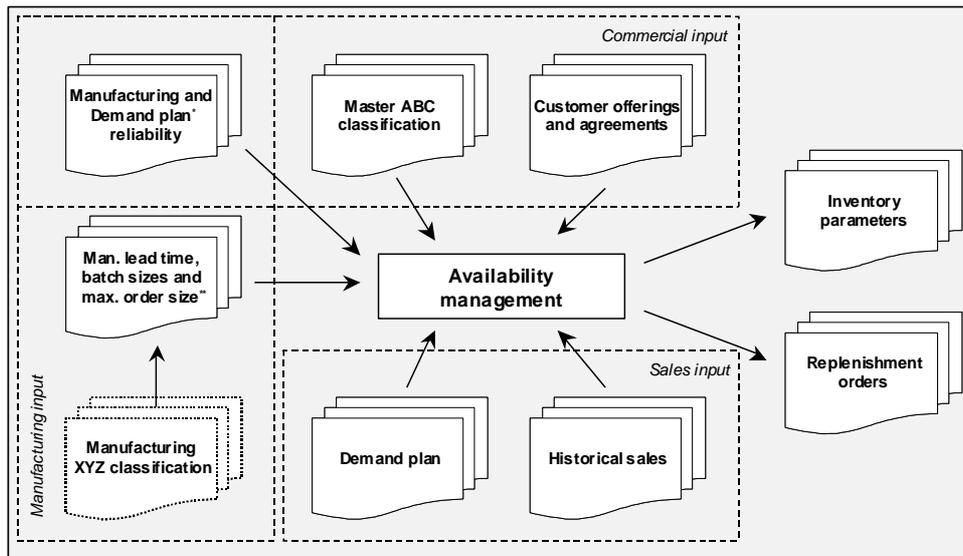
The second newly introduced function is **Availability Management**. Availability Management must determine the right amount of inventory per product code, by setting the right inventory parameters and placing the right replenishment orders at the right time.

To do that, Availability Management must combine several sources of information to define different availability policies (shown in figure 5-14):

- Commercial input customer offerings defined by Master ABC classification and additional offerings to customers as a result of competitive advantage.
- Manufacturing input with lead times, batch sizes and maximum order data, and demand reliability.
- Sales input: such as demand plans and historical sales.

As part of defining new roles and responsibilities, a RACI (R-responsible, A-Accountable, C-consulted, I-informed) structure for each function and processes was introduced. Examples of it can be seen in Appendix (Figure A-3). The purpose of it was to clarify accountability structure.

Figure 5-14: Concept of Availability Management



Source: KPMG, Final report, 2001, p.31

The role of Availability Management has changed over time. Partly it was moved to Supply Chain Planning. Thus the role of availability management process has become very operational. Consequently, the activities carried out in Supply Chain Planning come to encompass part of availability management processes (i.e. stock parameter set up) and tactical and strategic activities related to planning. On the other hand, some sub processes in Availability Management were not developed and implemented properly, due to lack of competences. Since the process of stock control on operational level was very poor, mistakes in reordering resulted in unnecessary amount of stock.

As mentioned already before (Subchapter 5.3), many of the agreements, whose purpose was to clarify responsibilities between the processes in the supply chain, were moved to Supply Chain Planning. By doing that, the other parts of supply chain lost the tool to make a clear agreement with other processes or functions up or downstream. This resulted in insufficient understanding of the concept, basically no process improvement and unclear responsibility split. On the other hand, this also had an impact on the focus in Supply Chain Planning. The main activities have been in the areas not directly related to planning (maintaining agreements in terms of XYZ, and ABC classification and based on that stock parameters set up and updating). The focus in the future should be on a more structured strategic planning process.

The reporting structure has also changed over time. Originally, Availability Management was reporting to Manufacturing. In year 2004, this was changed. Availability management and supply chain planning activities were merged into one department called Supply Chain Management. The name itself is misleading, as Supply Chain Management as the department is only managing part of the complete DH supply chain.

In the past years, managers in Purchasing and Manufacturing as well as Availability Management have been changed. Knowledge was not passed on to new managers sufficiently, knowledge was lost, and focus changed. The reason is that after implementing the new organization the RACI model was not used to clarify responsibilities. Additionally, bigger changes (moving the production facility from Germany to Slovenia) caused some side effects as well. Due to lack of organization planning, new people needed to execute additional work caused by extending operation in SIDH, were not hired early enough, and education of those people was inadequate. People that knew the design principles of the implemented supply chain model were overloaded; mainly all improvement efforts were stopped, as the need to keep operation running at least with the same performance was the main focus. As so many structural changes happened, the ownership of operational processes was not clear and this had a significant impact on stock levels.

*If we try to **evaluate the existing organization**, we find that the strength of it is that within “Operations” all processes related to managing the orders throughout supply chain are joined. The lack of focus on processes has caused that some of them are not defined completely. One of the reasons can also be that the organization planning process, as part of management processes, is not structured enough, so that the roles of each function could be clearly understood and relevant processes to carry out key activities developed further. This can also mean that people assigned to different roles didn’t have necessary technical and managerial skills to execute their responsibilities effectively. Effective organization should reflect key activities and processes (Cohen, 2004, p. 108) that support the overall business strategy. As business requirements have changed over time, a review of critical processes to manage supply chain should also be made. If we say that one of key business strategies is growth in all product areas on all markets and with further acquisitions, the key activities that need to be addressed in the supply chain are related to managing the introduction of new products on the markets, and integration of new markets in the supply chain by strategic supply chain planning. Integration of new companies in the supply chain is another activity which is also closely related to IT support. Process development and automation is another critical task to optimise the cost of order processing. From there on, the responsibilities for reviewed processes should be clearly defined, which today is not the case. Unclear responsibility for operational purchasing processes is an example of that.*

Another important dimension for the future, is to focus on critical skills and capabilities, needed to execute the processes, where the principle - organize around the skills needed, and not the ones available - should be used.

Internal capabilities can be considered as core when they are defined as competitive advantage or are otherwise essential for achieving the company’s strategic

objectives (Cohen, et al., 2004, p. 121) related to competitive advantage, business growth, customer service, and superior offerings. If we say that service level is the market winner, then supply chain has to be agile (see Figure 3-3). This means that the supply chain has to operate with low fixed assets, has a shorter innovation cycle, assembly is often modular, and flexibility is key because of rapidly changing product requirements. Therefore, core capabilities should be designed around flexibility, reducing fixed assets, and modular products development.

In general, we can conclude that a more structured approach should be applied, especially in terms of strategic planning, connecting business strategies to overall supply chain objectives and targets for individual functions.

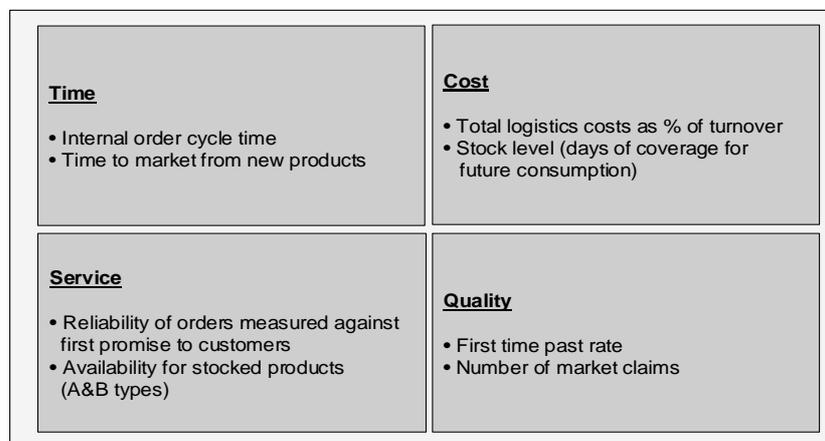
5.5. BALANCED METRICS

A measurement system, as one of the building blocks needed for effective supply chain management, was also developed in 2001. As part of that four major critical success factors for integrated supply chain of DHBA were identified.

Those four critical success factors are (shown in the Figure 5-16):

1. **Time:** Key performance indicators in this area are internal cycle times and time to market for new products.
2. **Service:** Key performance indicators are reliability of orders measured against first promise to customer and availability of stocked products (A&B types).
3. **Cost:** Key performance indicators are total logistic cost as % of turnover and Stock level (days of coverage for future consumption).
4. **Quality:** Key performance indicators are first time pass rate and number of market claims.

Figure 5-15: Balanced Scorecard



Source: KPMG, Final report, 2001, p. 22

All of these high level indicators were further split either per area of product, material type, or market where products were sold. Some of them can be seen also in Appendix (Figure A-4: Objectives per Critical Success Factor for DH Operations).

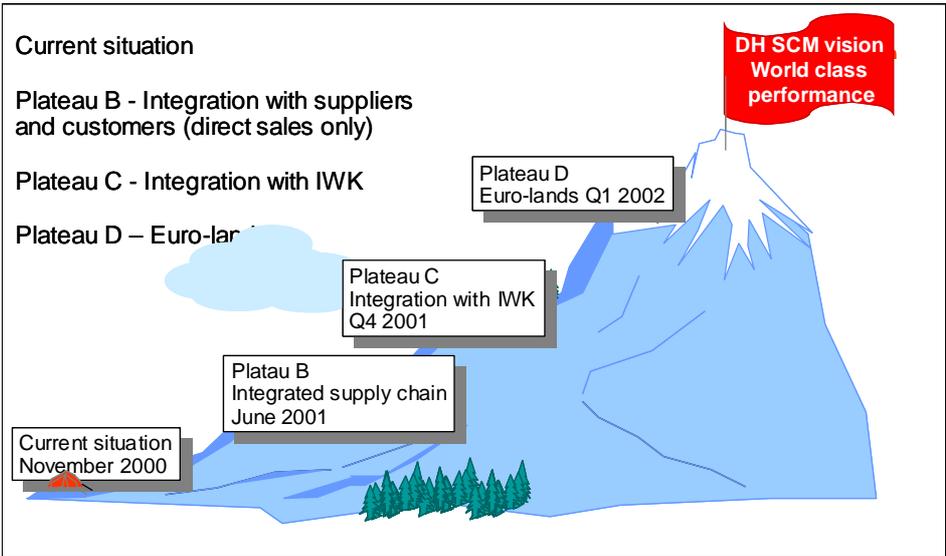
If we compare the existing measurements with the ones set originally, there is a vast gap in terms of existence and in terms of how targets are set. Even when comparing different reports from the start to the end of implementation, we can also notice that the consistency of indicators is not very high, as KPI's (key performance indicators) were actually changing. Also, if we compare metrics with the ones suggested in literature we can see that definitions are different or are missing. An example of that is also the definition of logistic cost.

5.6. DHBA SUPPLY CHAIN STRATEGY IMPLEMENTATION

As the results, of integrated supply chain model implementation, are coming slower than it was planned, it is important to review the implementation process and identify if this was the reason for that.

To be able to get from a fragmented supply chain (in year 2000) into an integrated supply chain in year 2001, and, in the final stage a synchronized supply chain in year 2002, the project was structured in different plateaus (Figure 5-16). To manage changes on broad areas different work streams were defined, joining people from different functions. In each plateau, major sub-projects were defined. Each of the sub-projects had pilot implementations for smaller areas of the supply chain to reduce the risk and reduce complexity of implementation.

Figure 5-16: DHBA Supply Chain Vision and Development Path



Source: KPMG final report, 2001, p. 16

Each plateau had several initiatives to be implemented and they are further on described more in detail. The description of each plateau also includes main barriers and bridges of implementing the plateau.

5.6.1. Plateau B: Integrated Supply Chain

The purpose of the integrated supply chain was to make the DHBA supply chain operate as a single rather than a fragmented supply chain. The cornerstone in the integrated supply chain is **reduction of the lead-time** in SIDH to 5 days and response time to DSC's to 1 day (+ transport) for A & B products.

The key initiatives grouped by different areas are:

- Management and organization:
 - Merging CDC logistic function and SIDH logistics to form “DH Operation” and introduction of new functions.
- Collaboration concept and agreements:
 - Introduction of master ABC classification towards end-customers.
 - Introduction of XYZ classification.
 - Introduction of new inventory policies.
 - Decoupling concept was introduced: From the decoupling point, the manufacturing lead-time should be 5 days.
- Process improvements:
 - Reduction of lead-time from DH Operation to DSC's and from SIDH to CDC with daily replenishments.
 - The procurement concept, which is based on three levels of procurement processes: operational, tactical, and strategic procurement.
 - Definition of core processes for DH operations to make clear agreements between all core supply chain processes, which shall create ownership, focus and transparency.
- Measurements system definition on the basis of critical success criteria.

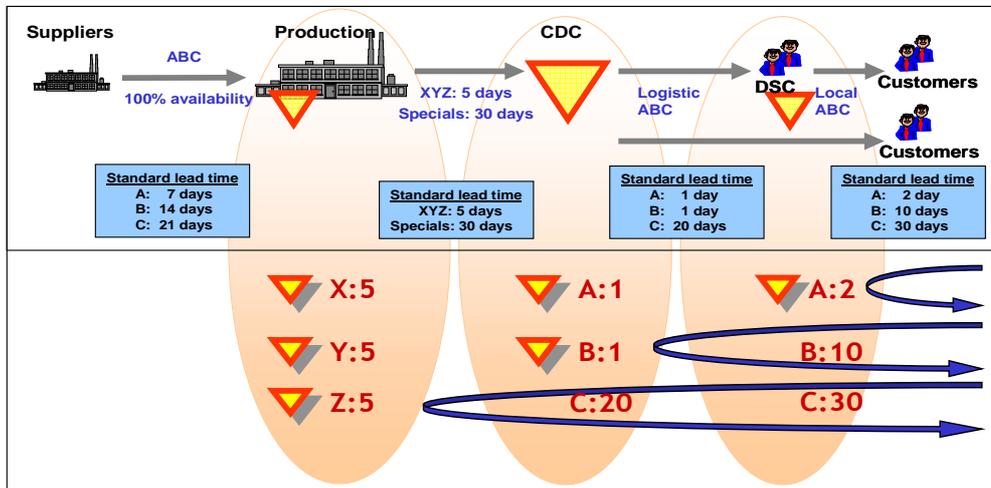
The goals of the Plateau B for lead-time as the key driver of stock reduction and service level improvement were: to customers of 2,10,30 days per different products, manufacturing lead-time of 5 days, and suppliers lead-time of 10 days (see Figure 5-17).

The main issues that have been critical during the implementation and are present even today, based on the knowledge of the company as well as interviews with the management are:

- *Lack of functional management focus and clear responsibility split.*
- *Operational procurement processes are not fully implemented.*

- *Measurement system was not fully implemented and it was very manual.*
- *Managers were not experienced enough.*
- *Deep understanding of the vision was missing.*

Figure 5-17: Objectives of Plateau B



Source: SCM strategy 2005, p. 10

5.6.2. Plateau C: Merge with Danfoss IWK Supply Chain

In order to maximize the synergies of the takeover of IWK, it was essential that the supply chains are firstly integrated and secondly fully merged. When integrating the supply chains, it was recommended, that the same supply chain principles are implemented, which in terms of management and organization meant:

- The new Supply Chain Planning function to be responsible overall for demand planning as well as managing the logistics side of phasing in and out of the joint product program in order to minimize obsolescence.
- Procurement to be integrated in order to recap the benefits of the new purchasing processes and achieve synergies in supplier agreements.
- In order to obtain a common reference for processes, communication and understanding of Danfoss IWK business Danfoss IWK manufacturing organization was aligned with the DH Operations organization, across all processes: availability management, manufacturing, operational procurement are established as functions etc.

As the integrated supply chain model from plateau B was very “fresh”, this also had an impact on the implementation of plateau C. In this phase, ability to manage across different locations and different cultures was crucial. In plateau C the main barrier for reaching the targets was actually the resistance to change as well as ability to manage across different cultures.

5.6.3. Plateau D: Euro-land / Synchronized Supply Chain

The synchronized supply chain was planned for the beginning of year 2002. The aim was to coordinate the activities with the Logistics 2001/ Euro-land project on Danfoss corporate level, where all DSC stock is to be returned to 2 to 4 regional stock /cross docking points in Europe managed by DH Business Area.

The enablers of the synchronized supply chain include the implementation of:

- Advanced Planning and Scheduling (APS) system, which will allow Danfoss to manage and optimise the supply chain from raw materials through to deliveries.
- 48 hours internal lead-time from customer order receipt through to manufacturing and distribution to regional stock points.
- Working with world-class suppliers and logistics service providers and utilizing the web based tools for integration of all parties in the supply chain. 2 to 4 stock points in Europe, from which all customers are supplied.

This part of the project was actually in the responsibility of DH management and in close coordination with the corporate project. The project was delayed for two years and it is still running. This delay mainly affects the service offering as well as stock levels.

Additionally, DHBA started to acquire new companies after year 2003. Despite big structural changes, a review of the overall supply chain vision has not been made in a systematic way so far. Also strategies that would enable coordinated efforts toward achieving the vision that was set in 2001 haven't been agreed.

The main reason is that the focus on the area of supply chain management has been decreased over last few years, due to the lack of ability to relate the achievements of supply chain management efforts to overall business results and due to the fact that resources needed for initial integration of those companies were significant.

As implementation of integrated supply chain management is a complex process, which depends on many internal as well as external factors, the targets related to improvement goals must also be realistically set and reviewed according to the ability of the organization and the actual result. An idea could be to organise improvement efforts in improvement projects, which would have sponsors in top management. This is especially recommendable when the improvements have to be achieved cross-organisationally: in different production, distribution or sales units.

6. ANALYSIS OF CURRENT PERFORMANCE

Further and deeper analysis of current performance starts with the analysis of current key performance indicators in comparison with the originally designed measurement system as well as the evaluation of actual result with respect to the targets. As part of this analysis also, the critical question about how well targets were set from year to year is discussed. At the end, the chapter summarises the benchmarking study that Danfoss made with PRTM, in year 2004.

Current key performance indicators (further on KPI's) are grouped according to the four main critical success factors as shown in Figure 5-15. Those groups are: time perspective, cost perspective, service perspective and quality perspective. Further on each of them is explained more in detail.

6.1. TIME PERSPECTIVE

The original list of time-related KPI's consisted of the following measurements: internal cycle time (drilled down to production lead time and suppliers lead time) and time to market (which is now out of the scope of operations). Let us look now at the performance of each of them and the main reasons for deviations.

Starting with the first KPI related to **time perspective: suppliers lead time**. Results obtained from Purchasing and Production monthly reports on supplier's lead-time show a positive trend but they are below the level set as objective in the project (average lead time of 10 working days).

The main reasons for these results are:

- Lack of focus and time due to involvement in other projects (transfer of production project).
- Logistic infrastructure on the market in terms of transport times and frequency of deliveries and price do not support short lead-time.
- Additionally, development in 2003 was considerably lower due to the transfer of production from Germany and insufficient knowledge and difficulties related to management of change by suppliers, as they were not prepared to cooperate with partners outside Germany.
- The priority of projects in Purchasing is focused on cost reduction from suppliers and not on total cost of ownership (including inventory level caused by bigger purchase volume or long lead time) and on reduction of supplier base (complexity).

The next KPI related to **time perspective** is **production lead time**. Results of production lead-time are showing a positive trend but they are below the level set as objective in the project (5 days in 2001 and 3 days + 5 days for transport). There are also no activities in place to further reduce production lead-time.

6.2. COST PERSPECTIVE

The original list of cost related KPI's included the following measurements: total logistic cost as % of turnover, stock levels (per material type, per location) and, the later added cost saving on procurement and variable cost reduction for production. Let us look now at the performance of the first two of them, as they were originally defined.

First the **logistic costs** will be analysed. Results on total logistic cost as % of turnover show a positive development, but according to the perspective target set back in 2001, they have not been developing in accordance to the targeted level (see Figure 6-1). In year 2003, the deviation from the targets started to increase. The primary reason for that was that logistic cost starts to increase in DKDH, and that in other parts (e.g. SIDH, DSC), they were not decreasing as planned. When we split cost by categories, the main reason for such development is stock, in all areas, which is explained more in detail in the next paragraph.

Figure 6-1: Logistic Costs as Percentage of Turnover (Total Net Sales)

Logistic cost as % of net sales	Total logistic costs				Total net sales				Logistic costs as % TNS			
	Actual 2001	Actual 2002	Actual 2003	Actual 2004	Actual 2001	Actual 2002	Actual 2003	Actual 2004	Actual 2001	Actual 2002	Actual 2003	Actual 2004
mio DKK/%												
DKDH (CDC)	10,1	9,2	12,8	15,3	186,3	201,5	195,1	236,9	5,4%	4,6%	6,6%	6,5%
SIDH	18,6	18,3	20,1	26,3	134,0	146,0	170,0	220,0	13,9%	12,6%	11,8%	12,0%
DEBC	20,0	18,0	16,0	0,0	90,0	100,0	100,0	50,0	22,2%	18,0%	16,0%	0,0%
DSC	21,1	21,7	22,6	25,0	130,4	137,6	192,8	223,2	16,2%	15,8%	11,7%	11,2%
Total	69,8	67,2	71,5	66,6	540,7	585,1	657,9	730,1	12,9%	11,5%	10,9%	9,1%
Reduction									-	-11,0%	-15,9%	-29,3%
Target										-25,0%	-30,0%	-40,0%
Deviation										-14,0%	-14,1%	-10,7%

Source: Author (estimate, based on actual Logistic cost reports 2001-2004)

Analysing the **stocks** we can conclude following. Results on stock as % of turnover (abbreviation in the Tables 6-1, 6-2: TNS: Total Net Sales) show a positive development, but according to the perspective target set back in 2001, they have not been developing in accordance to the targeted level (see Figure 6-2).

Deviations from the target started to grow in year 2003. The high stock in production is due to the lack of focus on suppliers' optimisation program as the decision was taken to transfer production from Germany to Slovenia. Part of the supplier optimisation program was also the implementation of vendor-managed inventory with key suppliers, which has not yet been implemented. **Reduction of supplier lead-time from 26 days to 10 days in average would enable a 40% stock reduction and this part would bring, additionally, around 10% in the overall result.** Stocks as % of net sales in Central Distribution Centre (CDC-DKDH), remained the same, or with respect to 2002, even increased by 1 % point.

Figure 6-2: Stock Costs as Percentage of Turnover (Total Net Sales)

Stock as % of net sales	Total stock				Total net sales				Stock% TNS			
	Actual 2001	Actual 2002	Actual 2003	Actual 2004	Actual 2001	Actual 2002	Actual 2003	Actual 2004	Actual 2001	Actual 2002	Actual 2003	Actual 2004
mio DKK												
DKDH (CDC)	28,5	20,9	22,3	26,3	186,3	201,5	195,1	236,9	15,3%	10,4%	11,4%	11,1%
SIDH	25,9	19,1	20,4	40,6	134,0	146,0	170,0	220,0	19,3%	13,1%	12,0%	18,5%
DEBC	35,8	24,1	21,0	1,6	90,0	100,0	100,0	50,0	39,8%	24,1%	21,0%	3,2%
DSC	30,2	31,0	28,2	25,0	130,4	137,6	192,8	223,2	23,2%	22,5%	14,6%	11,2%
Total	120,4	95,1	91,9	93,5	540,7	585,1	657,9	730,1	22,3%	16,3%	14,0%	12,8%
Reduction									-	-27,0%	-37,3%	-42,5%
Target										-40,0%	-64,0%	-70,0%
Deviation										-13,0%	-26,7%	-27,5%

Source: Author (estimate, based on actual Logistic cost reports 2001-2004)

The most significant reason for that was that due to high deviation in demand, lower stock level would have resulted in reduced service level to the customers. Despite the increased effort to improve demand planning and agree on smaller and more frequent ordering with main customers, deviations are still too high to achieve the targeted stock levels. By **improving demand planning** and **additional shortening of lead-time** from production, the stock reduction would have been 40% in DKDH and this would add an additional **7% improvement to the overall result.**

Even though stocks in Danfoss sales companies have been reduced, the **complete consolidation of stocks** has also been delayed for two years, which has a significant impact on the overall level of stocks. According to a draft estimate, **consolidation of stocks** would bring a reduction of stock **in DSC of approximately 10%.**

6.3. SERVICE PERSPECTIVE

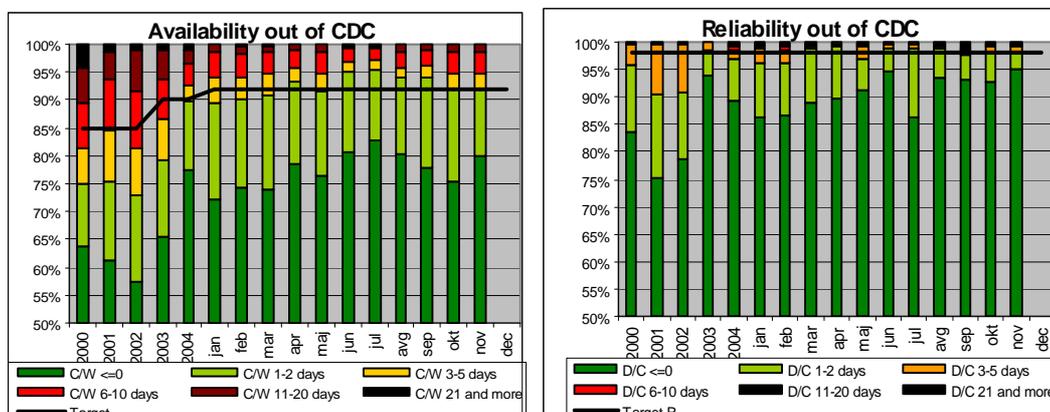
The original list of service level related KPI's consisted of: reliability for all components, in all different parts of supply chain, availability for stocked products (A, B) and lead - time for make-to-order products.

First of all, it is important to note, that lead-time towards customers is not measured due to the difficulties of setting up a proper definition. The other KPI's are measured, but not consistently over time. Because of that, it is not possible to follow performance over time and evaluate improvements.

The first indicator that is measured and will be analysed is **service level to the customers**. Existing measurements for service level on the market are unreliable. The main reason for that is that the process of order confirmation is different from market to market. Danfoss is selling a lot of products in Eastern European markets, where the prepayment from customers is required. This also means that the definition of key performance indicator should actually take in consideration customer orders that are delivered later than the customer has originally required, due to delayed payments by the customers themselves. It is only possible to see development of current KPI, but not actual performance as the definition and order intake process is not aligned across Danfoss Sales Companies. However, the development shows the right direction but actual performance is difficult to evaluate, due to problems already stated above.

The next measurement is **service level out of Central Distribution Centre**. This particular KPI can be followed from year 2000 on (see Figure 6-3). The development over time shows that in years 2002 and 2003 the actual result was below the target, but in year 2004 the target was achieved.

Figure 6-3: Service Level Measurements: Availability and Reliability for CDC from 2000 to 2005



Source: DH Service level report, 2005

From this KPI (Figure 6-3) it is also possible to see, that the targets were increasing over time.

The measurement of **service level from production units to Central Distribution Centre** is the next one to be analysed. Service level from production to Central Distribution Centre is also a measurement that has been changed a few times over the last years so the development is difficult to follow (see Figure 6-4).

Figure 6-4: Service Level Measurement from Production (SIDH) to CDC and from Suppliers to SIDH



Source: DH Service level report, 2005

The target is to deliver 95% of orders on time (up to 1 day delay - as described in Figure 6-4). The actual result in 2004 was 73% in the beginning of year 2005 this has increased significantly and has reached an average level of 85%. The line the Figure 6-4: Service level SIDH, shows the actual result of achieved delivery time (WLT).

The last measurement in the group of service measurements is **service level from suppliers to production**. Unfortunately, it is not possible to follow service level from suppliers to production units over time. Results are available from year 2004 onwards. Nevertheless, the actual result in year 2004 is bellow the target (see in Figure 6-4). There are different reasons, such as: delays from suppliers, the demand that is much higher than planned, incorrect master data (which can cause ordering mistakes, and are related to sourced parts, suppliers and ordering parameters).

6.4. QUALITY PERSPECTIVE

In this area, there were several key performance indicators specified. Among others: customer perception of logistic on very high level, first time pass rate in production

and quality of planning. Most of these KPI's are not measured in the same way today. Unfortunately, also, customer surveys regarding satisfaction have not been repeated since 2002. The only measurement that exists is the quality of demand plan. A measurement, added later on, was the quality of ABC classification of finished products. This classification is made on the basis of turnover and order lines and is defined on one hand, by customer offerings and on the other hand, by stocking policy. Thus, with A product 80% of turnover should be made, with B 15 % and the remaining part with C products. The quality of this classification actually has a great impact on stock levels as well as on overall availability of products. The actual result is very close to the target.

To **summarize the analyses of existing KPI's** in all four areas: time, cost, service and quality, we can conclude that the measurement system that was designed already in 2001 has been simplified or modified significantly. Some of KPI's on availability management, and supply chain planning, are not measured any more or they were not implemented. Customer perception of logistic is an example of that. The same has happened in manufacturing (e.g. first time pass rate in manufacturing) and purchasing (e.g. availability of raw materials for production). Some of the measurements were added later on. Examples of such measurements are manufacturing efficiency and purchasing savings, as well as ABC classification quality.

As there is no structured process of defining KPI's, it seems that targets are not fully understood and responsibilities are not clearly defined (especially in relation to stock levels). There is also no evident connection between operational targets and financial performance. Due to that commitment to achieve those targets is not high enough. In the future a clear link between operational targets and financial performance should be established to improve the connection and commitment to achieve stated objectives.

There is no clear ownership and mechanisms in place, which would assure immediate and effective corrective actions in case actual results are bellow target. Further efforts should be made towards a more consistent management of performance or to include those targets also in incentives for the employees achieving those targets or negative incentives if targets are not met.

Planning of the activities for the future is also very closely related to the control procedure. In that respect target setting procedure is not evident enough. As the activities should be closely related to the targets, probably also this is the area that would need more focus in the future; especially in terms of prioritizing activities according to its contribution to the desired target.

6.5. BENCHMARKING SUPPLY CHAIN PERFORMANCE

In year 2004 DHBA, made a benchmarking survey based on complexity research that PRTM was conducting. Results in the survey are based on the actual achievements in year 2003. The result of this survey showed (Figure 6-5) that in comparison with best in class companies DHBA has a good position in terms of financial performance. On the other hand, there are still big opportunities on the supply chain area. DHBA has comparable service levels as industry peers but with higher investment in inventory. But as already stated in Subchapter 3.3, asset turns does not directly correlate to supply chain management maturity.

Figure 6-5: Benchmarking DHBA Supply Chain Performance

	0% - 20% Major Opportunity	20% - 40% Disadvantage	40% - 60% Average or Meridian	60% - 80% Advantage	80% - 100% Best-in-Class
Financial Performance					
COGS as % of revenue for the year 2003	81%	▲ 62%	51%	▲ Danfoss	17%
Supply Chain Performance					
Total Inventory Days of Supply	360 days	▲ Danfoss	75 days ▲ 85 days		36 days
% of orders delivered on-time to the customers requested dates	58%		75%	▲ 84% Danfoss	97%

▲ Danfoss ▲ Communications and Electronics, Automotive&Industrial

Source: *Managing complexity in Global supply chains*, PRTM, 2004, p. 26

Despite that, to achieve the level of “Best in Class companies” there are plenty of opportunities, especially the inventories. One of the main reasons for high stock is the stock of raw materials. Primary cause for that is very complex supply base, which is very difficult to manage and control. Due to that, further efforts should be made to reduce complexity of supply base to be able to improve management of suppliers and consequently reduce stocks and management cost. We can draw another conclusion. Considering the good financial performance, the focus should be more on service level improvement as well as stock management, and less on material variable cost reduction.

Additional assessment was done on the basis of the process performance. The processes were evaluated based on the PRTM methodology and they were grouped according to the definition of the SCOR model. The evaluation presented in Figure 6-6 showed that all processes are on a relatively high level in comparison with the peers.

Figure 6-6: Maturity Level of Supply Chain Processes

	Stage 1 <i>Functional focus</i>	Stage 2 <i>Internal</i>	Stage 3 <i>External</i>	Stage 4 <i>Cross enterprise collaboration</i>
Plan				
Source			 	
Make		 		
Deliver				

 Danfoss  Communications and Electronics / Automotive Industry

Source: *Managing complexity in Global supply chains, PRTM, 2004, p. 24*

Nevertheless, there is a considerable gap in two processes, make and deliver, where the future focuses should be to improve them and assure in that way a better supply chain performance.

7. STRENGTHS AND WEAKNESSES OF CURRENT SUPPLY CHAIN MANAGEMENT AND INITIATIVES FOR THE FUTURE

For overall evaluation of supply chain management, the core disciplines as described by Cohen (2004, p. 12) will be evaluated. Those core disciplines are:

- To view supply chain as a strategic asset (designed around a defined basis of competition to enable overall business strategy).
- To develop end-to-end processes and systems to interface efficiently with the rest of the organization, to design the organization and necessary skills required.
- To build the right collaborative model based on the understanding of core competences and selection of right partners.
- To maximize focus and profitability.
- And last but not at least, to use metrics to measure the health of the processes and identify problem areas.

From a rough analysis of strategies, processes, infrastructure, measurement system and organization, from mapping of existing KPI's and results of benchmarking study, as well as interviews with key process owners on what the main opportunity areas are, it is possible to conclude that on most of the disciplines there are good practices

in place, but a major area for improvement is to re-evaluate the vision of supply chain, review core processes and responsibility structure and implement a more effective measurement system as well as management and organization. Further, each area is evaluated more in detail.

7.1. STRATEGIC ORIENTATION

According to Cohen, the supply chain strategy designs a unique supply chain configuration that drives strategic objectives forward and has five building blocks: manufacturing strategy, outsourcing strategy, channel strategy, customer service strategy, asset network. The main strengths and weaknesses are shown in Table 7-1.

Table 7-1: Strengths and Weaknesses of DHBA Supply Chain Strategy Main Building Blocks

Key strategy building blocks	Strengths	Weaknesses
Manufacturing strategy	<ul style="list-style-type: none"> Manufacturing strategy make to order is defined and and it is used as recommended in literature Decoupling points have been mapped and documented 	<ul style="list-style-type: none"> Strategies for further optimisation of lead time are not clearly defined
Channel strategy	<ul style="list-style-type: none"> Channel strategy is defined and documented, direct distribution is used for customized products and indirect distribution channel for standard products It is systematically reviewed 	<ul style="list-style-type: none"> Strategy is focused mainly on European markets and must be deployed to Global markets where future growth is expected
Outsourcing strategy	<ul style="list-style-type: none"> Outsourcing strategy is for machined parts is defined, depending on volume and suppliers competences 	<ul style="list-style-type: none"> Outsourcing strategy for other processes and activities is not clearly defined
Customer service strategy	<ul style="list-style-type: none"> Clear overall service level is defined as well as specific service offering for key accounts 	<ul style="list-style-type: none"> Customer service strategy is not clearly documented Service levels according to customer importance is not defined
Asset network	<ul style="list-style-type: none"> Warehouse consolidation strategy for Europe is defined 	<ul style="list-style-type: none"> Asset network strategy is not documented in terms of regional, global or local manufacturing facilities, order desks, production equipment

Source: Author

From the evaluation of strengths and weaknesses, we can see that despite a lot of strengths related to different key parts of supply chain strategy, there are also some weaknesses. The most critical one is **long-term asset network**. With increasing complexity of the supply chain, in the future very careful evaluation of long –term asset network, depending on customer requirements, type of demand, as well as the cost base, will be required. Another point that can be significantly improved is **outsourcing strategy**. Especially in the areas that are not directly linked to

manufacturing. One example can be warehousing, or other processes not perceived as core competence, such as stock control optimisation for purchased materials.

The supply chain strategy was also evaluated based on the four main criteria as defined by Cohen. The strengths and weaknesses are mapped in Table 7-2.

Table 7-2: Strengths and Weaknesses of DHBA Supply Chain Strategy by Main Criteria's

Key criteria's for good strategy	Strengths	Weaknesses
Aligned with business strategy	<ul style="list-style-type: none"> Basis of competition are defined 	<ul style="list-style-type: none"> Supply chain strategy could be more differentiated depending on the basis of competition for different markets and different products
Aligned with customer needs	<ul style="list-style-type: none"> Overall market winning criteria is defined in terms of service level 	<ul style="list-style-type: none"> Market winners are not clearly defined for certain market, different product groups They are not defined according to type of demand for different product groups (innovative products requires responsive supply chain, and functional products efficient supply chain)
Aligned with power position	<ul style="list-style-type: none"> Bundling of purchasing volume with other Danfoss Segments Developed distribution channels to assure global presence Strong relationships with key customers 	<ul style="list-style-type: none"> Relationships with key suppliers could be stronger (VMI, joined development projects) Segmentation of different customers would be needed for further development of collaboration with Key customers
Adaptive	<ul style="list-style-type: none"> The relationships among companies in internal supply chain are adopted according to changes in infrastructure The use of advanced technologies in internal supply chain 	<ul style="list-style-type: none"> Use of new technologies in terms of internet are not exploited enough The revision of supply chain strategies according to power position, new competitors is not structured processes

Source: Author

From evaluation of strengths and weaknesses shown in Table 7-2 we can derive, that the common area for improvement is **systematic alignment of the strategies** with the changed **business requirements**, such as entering new markets where the focus on good service level is very important to have a competitive advantage. Another dimension is also related to alignment of strategies to **customer needs**. Here market winners for certain customer segments are not clearly defined; they might also be different for different products and the type of demand for those products. As the Danfoss brand has a strong position on the main mature markets and a weaker **brand position** on emerging markets, this should also result in a clear collaboration strategy. On the markets where DHBA has a strong position, the distribution channels can be more direct while for emerging markets, the knowledge of local partners can be used to penetrate the market faster.

As DHBA is growing fast, the strategic supply chain planning and alignment of key building blocks should be one of the main processes there.

7.2. PROCESSES AND IT SUPPORT

To evaluate current strengths and weaknesses of processes I compared processes that were designed in the initial project, with the actual level of implementation by interviewing people working with the processes today as well as by interviewing managers of the processes. The key processes that were analysed here and mapped in Table 7-3 are:

- Supply chain planning.
- Availability management.
- Manufacturing.
- Purchasing.
- Order and customer relationship management.

Table 7-3: Strengths and Weaknesses per Key Processes in DHBA Supply Chain

Key process	Strengths	Weaknesses
Order intake	<ul style="list-style-type: none"> ▪ Completely integrated among internal members of the chain (Production, CDC, DSC) 	<ul style="list-style-type: none"> ▪ Not systematically reviewed, and not aligned across supply chain ▪ Very manual towards customers ▪ Complex, due to complex product range
Availability (Stock) Management	<ul style="list-style-type: none"> ▪ Automated ▪ Integrated (CDC, DSC) 	<ul style="list-style-type: none"> ▪ Process documentation ▪ Exception management
Manufacturing	<ul style="list-style-type: none"> ▪ Automated ▪ Integrated 	<ul style="list-style-type: none"> ▪ Process documentation ▪ Process improvement ▪ Poor exception management
Purchasing	<ul style="list-style-type: none"> ▪ Documented processes ▪ Between units are automated ▪ Exchange of data with suppliers 	<ul style="list-style-type: none"> ▪ Poorly developed operational processes ▪ Supplier improvement programs ▪ Manual with external suppliers
Supply chain planning	<ul style="list-style-type: none"> ▪ Good documented processes ▪ Alignment of processes with changed requirements 	<ul style="list-style-type: none"> ▪ Strategic planning process ▪ Complex demand planning

Source: Author

From Table 7-3 we can conclude that the main improvement area is a systematic approach to process documentation. From the interviews made with key owners of the processes it is evident that there has not been an overall revision of processes with respect to changes in business needs or new technologies. Some improvement initiatives are present here and there but without overall coordination effort.

From the interviews it is also evident that the ownership of processes is not clear enough (e.g. operational purchasing), which is causing inefficiency and low improvement level.

Regarding IT infrastructure, the processes are supported with SAP, use of advanced technologies and practices such as APS and web or EDI is limited mainly to internal supply chain (production, CDC, DSC) and deployment towards suppliers and customers could be explored to a higher degree.

7.3. MANAGEMENT AND ORGANISATION

Evaluation of management and organization is another key component of successful supply chain management. Its key strengths and weaknesses are shown in Table 7-4.

Table 7-4: Strengths and Weaknesses: Management and Organization

Characteristics	Strengths	Weaknesses
Providing skills and competences	<ul style="list-style-type: none"> ▪ Corporate Danfoss initiatives for certain areas (productivity programs, purchasing programs) ▪ Internal education ▪ Improvement culture 	<ul style="list-style-type: none"> ▪ Structured education on supply chain management ▪ Knowledge database is missing ▪ Definition of core competences is missing
Having metrics	<ul style="list-style-type: none"> ▪ Key metrics in place 	<ul style="list-style-type: none"> ▪ Should be better aligned with overall business targets ▪ Target setting not ambitious enough
Following design principles (RACI)	<ul style="list-style-type: none"> ▪ Based on processes 	<ul style="list-style-type: none"> ▪ Shared responsibilities are poorly defined ▪ Periodical reviews are missing

Source: Author

As we can see in the Table 7-4 the strength of the management and organisation is that there are structured initiatives in the area of providing skills especially in terms of manufacturing processes, and that improvement culture is high. However, the structured education in the area of supply chain management is an element that can be improved. Due to the fact that management has also been changed, the knowledge base in terms of documented processes and update of them can also be improved.

Concerning metrics, the key ones are in place, but it is very difficult to see how they are related to overall targets achievement and the target setting procedure is not ambitious enough.

In terms of design principles overall activities are based on processes, on the other hand, some of the shared responsibilities are not defined clearly and based on the interviews, they should also be revised more frequently.

7.4. COLLABORATION MODEL

To evaluate the level of collaboration, the main areas are split into cooperation between processes, collaboration with other functions, collaboration with external/internal suppliers, customers, and with other partners in the supply chain (see Table 7-5).

Table 7-5: Strengths and Weaknesses by Areas: Between Processes within Operations, with Other Functions, with Internal/External Suppliers, Customers and Other Partners

Key areas	Strengths	Weaknesses
Between key processes within operations	<ul style="list-style-type: none"> ▪ Integrated ERP system ▪ Defined rules between processes 	<ul style="list-style-type: none"> ▪ Understanding of the rules and agreements
With other functions DH	<ul style="list-style-type: none"> ▪ Documented procedures for introduction and discontinuation of products ▪ Good cooperation with finance regarding internal evaluation of internal turnover based on demand plans, evaluation of stock ▪ Yearly capacity planning process, taking into account bottlenecks and outsourcing possibilities 	<ul style="list-style-type: none"> ▪ Cooperation with sales could be improved, in terms of service targets alignment for main markets and main customer groups and overall customer offerings
With internal / external suppliers	<ul style="list-style-type: none"> ▪ Sharing demand information ▪ VMI in internal supply chain ▪ Measurement of performance and sharing gains (suppliers bonus) ▪ Involvement of external suppliers in development projects 	<ul style="list-style-type: none"> ▪ VMI (outsourcing of stock control for raw materials) ▪ Agreement on targets and follow up procedure ▪ Automation of order placement (external suppliers)
With internal/external customers	<ul style="list-style-type: none"> ▪ EDI ordering ▪ Demand information sharing (with some key account) 	<ul style="list-style-type: none"> ▪ WEB and EDI ordering from external and some internal customers can be deployed and strategy aligned
With other partners	<ul style="list-style-type: none"> ▪ Distribution partners 	<ul style="list-style-type: none"> ▪ Low level of automation with local logistic service provider

Source: Author

Collaboration between processes within operations is very good among “old” members of DH supply chain as processes are defined, companies are using an integrated ERP system, and clear rules are set among them (ABC, XYZ, mentioned in Chapter 5). On the other hand, better understanding of rules and agreements as well as their follow-up would still be needed. The situation is completely different in newly acquired companies, who have their own processes, their own ERP systems, and no clear definition of rules and agreements among them.

Collaboration with other functions in DH has a lot of good initiatives, such as documented procedures for introduction and discontinuation of products, close link with Finance on yearly and quarterly basis, to agree on internal turnover, stock and obsolescence. A yearly capacity planning process to agree on how to meet customer demand is in place. The area that would need to be improved is cooperation with Sales. Especially in terms of targets for service levels and customer offerings.

In the area of **collaboration with internal/external suppliers and customers**, we can generally conclude that internal collaboration is good in the “old” part of the supply chain (links between DSC, CDC, and production unit). On the other hand collaboration with newly acquired units is still very low. Moreover, collaboration with external suppliers and customers is also very low. Further efforts should be made to prepare a clear collaboration strategy with external partners, either in terms of in sourcing or outsourcing operational activities of stock control, by using the VMI concept. External collaboration with customers and suppliers should also define other possible collaboration initiatives, such as e-commerce, web ordering.

7.5. MEASUREMENT SYSTEM

The evaluation of the measurement system is divided into six characteristics that define a good measurement system (Cohen, 2004, p. 188):

- They must be aligned with business strategy.
- They must be balanced and comprehensive; they need to take into account the financial dimension, internal dimension, customer dimension, and innovation and learning dimension.
- Targets must be set on both internal and external benchmarks.
- Targets must be achievable.
- Metrics must be highly visible and monitored at all levels of the company.
- They must be used as a continuous improvement tool.

The strengths and weaknesses of DHBA measurement systems are presented in Table 7-6. The most important strength of the measurement system is that high level KPI's are part of the yearly planning process. For example, stock targets are aligned with turnover targets as well as planned activities related to reducing stock (such as improved performance from suppliers).

Another perspective is also that measurements are balanced; this means that they take into account the financial dimension as well as the internal dimension (e.g. stock levels, lead time-measurements, service level).

By some of the KPI's targets are set both on internal and external benchmarks, and they are achievable (e.g. service level to customers).

Table 7-6: Strengths and Weaknesses of Measurement System

Key areas	Strengths	Weaknesses
They must be lined to business strategy	<ul style="list-style-type: none"> ▪ Main KPI's are part of yearly planning process 	<ul style="list-style-type: none"> ▪ On KPI's is not possible to see to which overall objective they contribute
They must be balanced and comprehensive; they need to take into account financial dimension, internal dimension, customer dimension, and innovation and learning dimension	<ul style="list-style-type: none"> ▪ Measurements are financial (e.g. stock levels, logistic costs) and operational (LT, Service level) 	<ul style="list-style-type: none"> ▪ Innovation expect and customer aspect is not covered ▪ They are not comprehensive enough ▪ Some of them are very manual
Targets must be set on both internal and external benchmarks	<ul style="list-style-type: none"> ▪ Targets are on some KPI's set ▪ Some benchmarks available 	<ul style="list-style-type: none"> ▪ In most of the cases they are not set on the base of benchmarks ▪ Some of them are not showing development over time
Targets must be achievable	<ul style="list-style-type: none"> ▪ Targets are set on the achievable level (service level out of CDC) 	<ul style="list-style-type: none"> ▪ Targets on suppliers service level are constantly bellow the target
Metrics must be highly visible and monitored at all levels of the company	<ul style="list-style-type: none"> ▪ Some of measurements are displayed on the whiteboard 	<ul style="list-style-type: none"> ▪ They are not monitored on all levels of organization ▪ It is difficult to overview them
They must be used as a continuous improvement tool	<ul style="list-style-type: none"> ▪ Only in some areas 	<ul style="list-style-type: none"> ▪ Deployment of use in all areas

Source: Author

Still, there are numerous areas, where the measurement system can be improved. This mainly relates to the content of the measurement system and aligning it to strategies, as well as target setting and visibility.

The conclusion can be, that due to unsystematic approach to the measurement system, some targets are set on the basis of yearly planning but they are very difficult to overview, and even harder to conclude if development over time is good or not. The commitment to use measurements as a management tool could be higher, if better connection between single measurements and business targets is made. This would also improve the decision-making process as well as the focus on resolving barriers.

7.6. KEY INITIATIVES FOR THE FUTURE

From the analysis of current supply chain management and impact on logistic cost and service level, we can conclude that the result would be achieved, if the management focus remained the same as it was in the beginning, when implementation started. Despite many activities that have happened since, service level increased, but stock level as one of key components of logistic cost, has not decreased as it was planned. This was primarily due to the postponed “Euro-land project” and reduced focus on implementation of VMI principles, due to changed priorities, as well as postponed “warehouse consolidation” project. From this we can conclude that the implemented concept is giving results, but management focus on supply chain area must remain high, as potential, especially after expanding supply chain of District Heating in past years, is still very big.

Taking that into account, coupled with the fact that complexity of DH supply chain increased in the past two years, the key initiatives for further development of supply chain management are presented in Table 7-7. Those initiatives can drive further improvement of supply chain management practices with the aim to contribute to competitiveness of DH as well as the overall result of the business.

Key initiatives are stated by building blocks as defined by Cohen (see Paragraph 3.1.): to view supply chain as strategic asset, end-to-end processes and systems to interface efficiently, management and organization, collaboration model and measurement system. For each building block, one improvement initiative is listed, with the explanation of the main goals and improvement potential, where this is possible to evaluate.

To estimate improvement potential, the contribution to financial targets is evaluated. On the basis of available data, I have used the formula from Lewin (see Figure 3-11 in Subchapter 3.5). The evaluation of the impact on overall business performance is made on the basis of estimating the contribution to RONA, as one of key financial measurement used in Danfoss. The numerator for RONA is profit, so RONA is heavily influenced by revenue and cost. Therefore, managing both revenue and costs is critical to overall performance.

For example, if we assume that improved service level to customers of 1 % increases revenue for the same percentage point, the impact on RONA for DH would be (assuming that all other factors are unchanged) 1 %. The similar logic is followed in all the remaining estimations, except for strategic supply chain planning where the improvement potential is biggest, as the assets involved represent the highest value, but evaluation of improvement potential would require extensive analyses of supply

chain infrastructure. This would result in the biggest improvement of RONA but is on the other hand, also the most sensitive one as impact on customer perception and society is the biggest.

Table 7-7: Key Focus Areas for the Future Supply Chain Improvements

Key areas	Improvement initiative	Goal of initiative	Impact on result
Strategy	<ul style="list-style-type: none"> Strategy review, alignment and strategic planning improvement 	<ul style="list-style-type: none"> Clarify the relevant strategies depending on key competitive advantage Reduce non value adding activities and implement the ones that can really contribute to result 	<ul style="list-style-type: none"> More strategic oriented SCM, focusing more effective infrastructure
Processes	<ul style="list-style-type: none"> Review key activities and needed processes 	<ul style="list-style-type: none"> Improve efficiency by streamlining processes (10 % improvement of supply chain management cost) 	<ul style="list-style-type: none"> RONA improvement of 1,5%
Management and organization	<ul style="list-style-type: none"> Further integration of supply chain organisation (RACI model) 	<ul style="list-style-type: none"> Improved service level 2% per year Reduced stocks for 10% Improved capacity utilization for 10% 	<ul style="list-style-type: none"> RONA improvement of 2% + 1% +1%
Collaboration model	<ul style="list-style-type: none"> Key partners selection (VMI/EDI) 	<ul style="list-style-type: none"> Lower stocks 20% More efficient sales order management process (1% in total cost to sell) Outsourcing of operational purchasing 	<ul style="list-style-type: none"> RONA improvement of 2%+0,5%+0,5%
Measurement system	<ul style="list-style-type: none"> Business goals oriented reporting 	<ul style="list-style-type: none"> Decision making based on fact Less time for analysing performance Better visibility 	<ul style="list-style-type: none"> More efficient management Better visibility of demand and stock data

Source: Author

Further, it is possible to see that the biggest improvement potential is in the integrated supply chain management, especially by integrating the Supply Chain Planning function to coordinate efforts along the entire DH supply chain. This concept is not applied to newly acquired companies in the DH supply chain even though it has proven to be successful. By integrating supply chain planning, the service level in the DH supply chain can be increased for 2% per year; stock reduced for 10% and capacity utilisation would improve as well. Integration of the planning process across the entire DH supply chain has an improvement potential measured by impact on RONA around 4% per year. It is important to mention that integrating supply chain planning would also require alignment of planning processes.

The ability to improve collaboration with suppliers and customers would result in 1% reduction of cost to sell, and 1% cost to acquire material, and would in addition contribute to stock reduction of 20% as only key suppliers and customers can be integrated. The total impact on RONA would be around 3 %.

As it was identified already in the context of accessing current performance and identification of key areas for improvement, it is very difficult to evaluate improvement potential by only looking into part of the business. On the other hand, much bigger potential for improvements lay in the companies that were integrated in the recent years.

8. CONCLUSION

Growth as one of the key preconditions to survive in the market is forcing companies to compete on international markets and at the same time defend domestic market share from international competitors. The result of that is increased complexity of supply chains, pressure to decrease cost, and improve service level. To cope with the complexity and increased customer requirements, active management of the supply chain is a prerequisite.

As supply chain is as a network of three or more entities directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer, management of it is a complex task.

Management of supply chain therefore requires the planning and control of activities to achieve a desired goal and shaping the organization by coordinating activities, goals, interests and relationships to be able to resolve conflicts and make good decisions.

Therefore for efficient coordination of decisions within supply chain, integrated supply chain management is of key importance. Essence of integrated supply chain management is supply chain planning and control, which has three important dimensions. The first dimension is functional integration, which involves decisions about purchasing, manufacturing, and distribution activities within the company and between the company and its suppliers and customers. The second dimension is geographical integration of these functions across physical facilities located on one or several continents. The third dimension is inter-temporal integration of strategic, tactical, and operational supply chain decisions.

Companies focusing on supply chain management can achieve competitive advantage by lowering costs and simultaneously improving customer satisfaction.

Those market trends and awareness of improvement potential that active management of supply chain can deliver were recognized in Danfoss DH Business Area already in year 2000. After the implementation of the new supply chain management concept through the year 2001, and 2002, with the assistance of KPMG consulting company, and further improvement efforts in later period, the evaluation of these efforts has been reviewed in the thesis. The results of current efforts are showing significant improvements over past years measured in terms of availability, logistic cost and stocks. However the DHBA supply chain achievements deviate from the targets stated back in 2001.

The **purpose** of this thesis was to identify the reasons for such development and to highlight the theoretical frameworks which could improve supply chain performance especially. The **ultimate goal** of the thesis was to present the management of DHBA with suggestions as to where it is necessary to focus in the future to achieve desired performance of supply chain.

For DHBA the most relevant definition of supply chain management is the implementation of key business processes. As the processes implemented in year 2001 and 2002 are based on SCOR model, most of the comparison was made on the basis of this model and Cohen's model for strategic supply chain management.

To be able to achieve ultimate goal, the main blocks needed for successful supply chain management as defined by Cohen were analysed and improvement possibilities identified. The analysis was done by combining the theoretical findings as well as practical experiences and experiences of people involved in the supply chain management at Danfoss.

The evaluation of strategic view of supply chain on the case of DHBA showed the following. The initial vision of DHBA supply chain was: the synchronized supply chain, the objective of which is to coordinate a customer order with production order as well as purchasing order with less than one week of inventory of finished products. By analysing implementation and development of it, we can conclude that the current vision is differently formulated, but heading in the same direction. The main difference is that the current vision does not answer the question how this can be achieved. Due to that, the coordination of activities across supply chain is harder. The recommendation for the future is that the vision should be better communicated. This would be especially valuable, because some of the key management has changed and also a lot of new companies become part of the DH supply chain.

From the analysis of key components of good supply chain strategy we can conclude that all building blocks, as defined by Cohen (2004, p. 18), are present in the supply chain strategy today and they actually support overall vision very well, but they have not been revised and structured in one document since year 2002. However a clear strategy in terms of network infrastructure and outsourcing needs to be further developed and improvement potential better explored in the future. In that way, also better deployment and understanding of supply chain vision and strategies can be achieved. A recommendation for the future is that strategies should be reviewed with the aim to align efforts across supply chain in the future better than they are today, and should also include the newly acquired companies. In that way better efficiency in managing of the supply chain can be achieved.

From the evaluation of the second building block, supply chain processes, we can conclude that processes are more or less implemented, but generally in the last few years DHBA is missing a structured approach to document and improve processes needed to carry out key supply chain activities needed to deliver products to the customers when they want them in the most efficient way.

Collaboration between processes is based on a very well defined agreements structure. Further efforts to improve efficiency of the processes and in that way also lower stock, should be in a better understanding of those agreements, which can also drive further development of the processes and extending those concepts also in the extended supply chain.

From evaluation of the existing organisation we can conclude that the strength of it is that all core processes related to managing the orders through supply chain are joined in the "Operations". However, business requirements have changed over past years. Therefore the review of critical activities and processes needed to achieve the objectives has to be made and organisation adapted to new situation. In that respect also the critical capabilities need to be reviewed. This would assure coordinated management of activities as well as better efficiency of processes.

The analysis of collaboration model with external partners is also an area for improvement especially in terms of defining key collaboration partners, to whom operational activities can be outsourced (talking about VMI with suppliers) or in sourced (talking about joined demand planning efforts with Key customers), or better utilisation of e-commerce to improve efficiency of operational processes (e.g. order placement).

Balanced metrics are also one of the key drivers for managing operational effectiveness of supply chain. Purpose of measurement system and the use of it can be improved. Especially as measurements can contribute to achieving goals and are

also effective tool for good decision making process, when they are designed properly. On the case of DHBA, the measurement shows that in the past years logistic costs were decreased by 20%, despite the fact that complexity of product as well as supply chain in terms of markets served has increased. On the other hand, service level as one of the targets mainly affecting turnover, has increased, stock level as one of key components of logistic cost has not decreased as it was planned. The main reason for that is the postponed “Euro-land project” and reduced focus on implementation of VMI principles, due to changed priorities, as well as postponed “warehouse consolidation” project.

From this we can conclude that implemented concepts and strategies are contributing significantly to the business result but due to many activities related to the structural changes of supply chain infrastructure, the management focus on optimising the supply chain was decreased.

For the companies that are seeking to integrate decisions across supply chain functions, across geographically dispersed facilities, and across time, integrated planning and collaboration between companies in the supply chain is becoming their most strategic activity. This means active management of supply chain.

In seventh chapter the contribution of key initiatives is evaluated based on their contribution to RONA, which is one of the indicator used in Danfoss, as the one that relate supply chain contribution very good to the business result.

Management of DH supply chain should make further efforts in the above mentioned areas, also in relation to the newly integrated companies. The alignment of the decision regarding distribution channels, positioning of inventories and better process efficiency can create value for the companies who are part of the supply chain.

LITERATURE

1. Anderson David, et al.: 5 Predictions that will make you Rethink Your Supply Chain. Supply Chain Management Review, September/October 2002, p. 26.
2. Anderson David, et al.: Synchronized Supply Chains: The New Frontier. Asctet, Volume 1, 1999, p. 1-10.
3. Ansoff Igor H.: Implanting Strategic Management. 2nd edition. Prentice Hall, 1990, p. 600.
4. Bolumole Yemisi: Supply Chain Management: A Review of Relevant Literature and Theory. Cranfield University, 2000, p. 2.
5. Chopra Sunil, et al.: Supply Chain Management: Strategy, planning, and operation. New Jersey: Prentice Hall, 2001, p. 448.
6. Christopher Martin: Better, Faster, Closer, URL: <http://www.martin-christopher.info>, 1.10. 2003.
7. Christopher Martin: The Agile Supply chain: Competing in Volatile markets, URL: <http://www.martin-christopher.info>, 1.10.2003.
8. Christopher Martin: Logistic and Supply chain Management. Financial Times Professional Limited, 1998, p. 17-21.
9. Christopher Martin: Developing Market specific Supply chain strategies. URL: <http://www.martin-christopher.info>, 1.10.2003.
10. Collin Jari: Selecting the Right Supply Chain for a Customer in Project Business. Helsinki: University of technology, 2003, p. 213.
11. Cohen Shoanen, Rousell Joseph: Strategic Supply Chain Management: The Five Disciplines for Top Performance. New York: McGraw-Hill, 2004, p. 1-250.
12. Cooper Martha C., Douglas M. Lambert, Janus D. Pagh: Supply Chain Management: More than a New name for Logistic. The International Journal of Logistic Management, Volume 8, 1997, p. 1-14.
13. Ducan Robert: The Six Rules of Logistic Strategy Implementation. London: PA Consulting Group, 2001, p. 1-5.
14. Domenica Nico, et al.: Supply chain planning and management. URL: <http://www.optirisk-systems.com>, 2.10.2003.
15. Donnelly, J. H., J. L. Gibson and J. M. Ivanchevich: Fundamentals of Management. Chicago: Irwin, 1995, p. 719.
16. Ernst Ricardo: Developing lasting Operational capabilities, IMP-30/Intenational management program, Holland, p. 2-106.
17. Fawcett Stanley: Achieving World-Class Supply Chain Alignment: Benefits, Barriers, and Bridges. Centre for Advanced Purchasing Studies, 2001, p. 11.
18. Fisher Marshall L.: What is the Right Supply Chain for Your Product? Harvard Business Review, 1997, p. 127-155.

19. Halldorsson A., Larson, P.D.: Wanted SCM! A Search for Elements of SCM in Logistics Education and Research, Transportation and Logistics Educators Conference URL: <http://www.redefininglogistics.com>, 2000, p. 216-241.
20. Handfield Robert B.: Supply Chain Redesign: Converting Your Supply Chain into an Integrated Value Stream. New York: Financial Prentice Hall, 2002, p. 38.
21. Hellriegel, Don and John W. Slocum: Management. 7th edition. Cincinnati: South-Western College Publishing, 1996, p. 799.
22. Kaplan Robert S., Norton David P.: The Balanced Scorecard: Translating Strategy into Action. Cambridge: Harvard Business Scholl press, 1996, p. 12.
23. Lambert Douglas M, et al: An Evaluation of Process-oriented Supply Chain Management Frameworks. The International Journal of Business Logistic, Vol.26, No.1, 2005, p. 25-45.
24. Lewin Steve, Supply Chain Decision Making. URL: <http://www.sourcetrix.com>, 1.10.2003.
25. Mason-Jones, Rachel, James B. Noyor, and Denis R Towill: Lean, Agile or Le-agile? Matching Your Supply Chain to the Marketplace. International Journal of Production Research, Vol. 38(17), 2000, p. 65.
26. Min, S., & Mentzer, J. T.: The Role of Marketing in Supply Chain Management, International Journal of Physical Distribution and Logistics Management, Vol.30, No 9, 2000, p. 765-787.
27. Meakem Glen T.: The global Supply Chain Management Imperative. Ascet, Volume 5, 2003.
28. Mentzer John, et al.: Defining Supply Chain Management. Journal of Business Logistics, 2001, Volume 22, Number 2.
29. Persson Ulrika: A Conceptual and Empirical Examination of the Management Concept Supply Chain Management. Luleå: University of Technology, 1997, p. 58.
30. Porter Michael E.: Competitive Advantage: Creating and Sustaining Superior Performance. New York: Free Press, 1985, p. 37.
31. Pučko Danijel: Planiranje in kontrola (Gradivo za študij). Ljubljana: Ekonomska Fakulteta, 2005, p. 135.
32. Rozman Rudi: Subject and method of organization = Predmet in metoda organizacijske teorije. Ljubljana: Ekonomska fakulteta, URL: <http://www.ef.uni-lj.si/>, 2000.
33. Rozman Rudi: Planiranje poslovanja podjetja. Zbirka Manager. Ljubljana: Gospodarski vestnik, 1993, p. 24.
34. Rozman Rudi, Kovač Jure, Koletnik Franc: Management. Ljubljana: Gospodarski vestnik, 1993, p. 312.
35. Schary Philip B, Skjott-Larsen Tage: Managing the Global Supply Chain. Copenhagen, Handelwhojskolens Forlag, 1998, p. 10-385.
36. Shapiro Jeremy: Beyond Supply Chain Optimization to Enterprise Optimization. Ascet Volume 3, 2001.

SOURCES

1. Accenture: A Global Study of Supply Chain Leadership and Its Impact on Business Performance, Accenture/Stranford/INSEAD Study 2003, p. 3.
2. Annual report Danfoss A/S, Intranet, 2004.
3. AT Kearney Competitiveness Survey, February 2005, URL: <http://www.cmocouncil.org>.
4. Centre for Logistics Management, University of Nevada, Executive Course 24 July 2001.
5. Danfoss intranet URL:<http://www.danfoss.com>.
6. DH Logistic report, 2001.
7. DH Logistic report, 2002.
8. DH Logistic report, 2003.
9. DH Logistic report, 2004.
10. DH Operations perspectives. 2005-2008.
11. DH Service level report, 2005.
12. DH Purchasing report, 2005.
13. SIDH Manufacturing report, 2005.
14. Final report, KPMG, 2002.
15. Introduction to Danfoss District Heating, Nordborg 2005, p. 1-57.
16. Longitudes 04, Mapping the New world of Synchronized Commerce, Conference report, Paris, France, October 25-26, 2004.
17. Longman Dictionary on line, URL: <http://www.ldoceonline.com>.
18. Management and Organisation report, KPMG; 2001, p. 7-25.
19. Perspective for District Heating Controls 2003-2008. Nordborg, 2003, p. 2- 60.
20. Perspective for Heating Division 2003-2008. Nordborg, 2003, p. 2-85.
21. Purchasing Budget 2003, p. 2-30.
22. PRTM Benchmarking Study, 2004, p.1-48.
23. SCM from Strategy to Implementation, presentation, 2003, p. 16.
24. Supply Chain Council: URL: <http://www.supply-chain.org>, 2005.
25. Supply Chain Council: Supply Chain Operations Reference Model, SCOR version 7.0. Overview, 2005, p. 7.
26. Supply Chain Strategy Document, Ljubljana, 2005, p. 2-28.
27. The Performance Measurement Group, LLC, Signals of Performance, 2003. p. 1-5.

APPENDIX

Figure A-1: Types of Products

	Functional	Innovative
Aspects of Demand	<i>Predictable demand</i>	<i>Unpredictable demand</i>
Product life cycle	<i>more than 2 years</i>	<i>3 months-1 year</i>
Contribution margin*	<i>5%-20%</i>	<i>20%-60%</i>
Products variety	<i>low (10-20 variants per category)</i>	<i>high (often millions of variants per category)</i>
Average margin of error in the forecast at the time production is committed	<i>10%</i>	<i>40% to 100%</i>
Average stock out rate	<i>1%-2%</i>	<i>10%-40%</i>
Average forced end-of-season markdown as percentage of full price	<i>0%</i>	<i>10%-25%</i>
Lead time required for made-to-order products	<i>6 months to 1 year</i>	<i>1 day to 2 weeks</i>

* Contribution margin equals price minus variable cost divided by price

Source: Fisher, 1997, p. 107

Figure A-2: Physically Efficient versus Market Responsive Supply Chain

	Physically Efficient Process	Market responsive process
Primary purpose	<i>supply predictable demand efficiency at the lowest possible cost</i>	<i>respond quickly to unpredictable demand in order to minimise stock-outs, forced markdowns, an obsolete inventory</i>
Manufacturing focus	<i>maintain high average utilization rate</i>	<i>deploy excess buffer capacity</i>
Inventory strategy	<i>generate high turns and minimise inventory throughout the chain</i>	<i>deploy significant buffer stocks of parts or finished products</i>
Lead-time focus	<i>shorten lead time as long as it doesn't increase costs</i>	<i>invest aggressively in ways to reduce lead time</i>
Approach to choosing suppliers	<i>select primarily for cost and quality</i>	<i>select primarily for speed, flexibility, and quality</i>
Product-design strategy	<i>maximise performance and minimize cost</i>	<i>use modular design in order to postpone product differentiation for as long as possible</i>

Source: Fisher, 1997, p. 108

Figure A-3: Example of RACI Structure for Procurement

Level 1 Process	Level 2 Process	Purchasing Manager	Lead Buyer	Operational Purchaser	Supplier	COO	Manufacturing site manager	Supply chain planning mgr	Manufacturing	Availability management	Fin Control	Fin admin	IT	Planning & analysis	Marketing & Sales	HVAC	Balancing Valves	R&D	Quality	HR	Order & Cust rel. management	DSC'S	LSP	Legal	
Procurement	Strategic procurement																								
	Procurement Marketing	A/R	R				I	I	I	I	I								C	I					
	Procurement Controlling	A/R (*)	R (**)	R (***)		C	C	C	C	C	C			I	I				C	I					
	Tactical procurement																								
	Vendor evaluation	A	R				I	C		I									CI	CI					
	Project management	A	R																R	R					
	Contract management	A	A/R				C	C		I									CI	CI					CI
	Master data management		A/R				I	I		I	C								CI	CI					
	Operational procurement																								
	Manual procurement of stock material			R			A	I																	
	Automatic procurement of stock material			R			A	I		I															
	Vendor managed inventory		C	C	R			A	CI																
	Subcontracting outside services		C	R			A		CI																
	Services			R			A		CI																
	Offer and order process			R			A		I										I	I	I	I			

Source: KPMG, Management & Organisation document, 2001, p. 23

Figure A-4: Objectives per Critical Success Factor for DH Operations

CSF	Objective	Result 2000	2001	Comment
Time	Internal order cycle time <ul style="list-style-type: none"> Manufacturing Suppliers DSCs 	6 weeks	5 days in mfg 10 days from suppl. 1, 10 & 30 days (as per ABC)	The 5 days of lead-time in manufacturing as per the blueprint
Time	Time to market for new products		Max 18 month from N1 to N5	
Cost	Total logistics costs as % of turnover	12%	10%	To be reduced to 7% by 2003
Cost	Reduction in stock levels		25% reduction in stock levels for 2001	
Service	Reliability of orders measured against first promise to customers	95%	98%	
Service	Availability for stocked products (A&B types)		100% for A products and 65% for B and C products	
Quality	Product quality	0,28%	Max 0,1% for BV and only 10 products of DH may exceed 0,2%	
Quality	Quality costs		Yearly reduction of 20% for scrap, rework etc. 0.8 to 1% of costs	
Organisation	Fully established BC Operations organisation	N/A	All positions filled by competent and trained staff	

Source: KPMG, Management & Organization document, 2001, p. 7

POVZETEK

V preteklih desetletjih je naraščal pomen upravljanja oskrbovalne verige, kot vlečnega konja za doseganje konkurenčne prednosti na trgu (Collin, 2003, str. 8). Številna podjetja so v devetdesetih letih investirala ogromna sredstva v izboljševanje oskrbovalnih verig z namenom, da bi izboljšala zadovoljstvo kupcev in povečala interno produktivnost. Kot pravi Christopher (1998, str. 130), danes na trgu ne tekmujejo več individualna podjetja, temveč gre za tekmovanje med različnimi oskrbovalnimi verigami. Oskrbovalne verige, ki dodajo največ vrednosti za kupca ob najmanjših stroških, so tiste, ki oblikujejo zmagovalno mrežo posameznih podjetij. Upravljanje oskrbovalnih verig ima v poslovnem okolju velik finančni učinek na vse deležnike vključene v verigo. Zato je raziskovanje, implementacija in izboljševanje oskrbovalne verige ključnega pomena za katerikoli globalno podjetje.

V Danfossu so se začeli zavedati pomena upravljanja oskrbovalne verige pred kar nekaj leti. Predvsem v okviru poslovnega področja daljinskega ogrevanja (PPDO), ki je tudi predmet preučevanje magistrske naloge. V letu 2000 je vodstvo PPDO začelo strateški projekt optimizacije oskrbovalne verige. Namen projekta je bil izdelati jasno vizijo oskrbovalne verige ter strategije, ki bodo zagotovile doseganje zastavljene vizije ter doseganje ciljev v smislu povečanja zadovoljstva kupcev in znižanja logističnih stroškov za 40%. Novo oblikovane strategije oskrbovalne verige temeljijo na skrajševanju pretočnih časov kot orodju za strukturiranje zalog v oskrbovalni verigi in preko tega zagotoviti večjega zadovoljstva kupcev in zmanjšanju logističnih stroškov.

Upravljanje oskrbovalne verige je za poslovodstvo PPDO ključna strategija za izboljšanje operativne učinkovitosti. Le ta, z naraščanjem kompleksnosti oskrbovalne verige v smislu širitve prodajnega programa in novih členov, kot so dodatne proizvodne enote, novi trgi in kupci, še dodatno pridobiva na pomenu. To pa je še dodaten razlog, zakaj je pomembno ugotoviti, kako usmerjati delovanje oskrbovalne verige v prihodnosti na način, ki bo zagotovil želene rezultate.

Problem, ki sem ga podrobneje analizirala v tej nalogi je, da rezultati vpeljave nove strategije oskrbovalne verige PPDO prihajajo počasneje kot je bilo pričakovano. Ker se PPDO hitro spreminja, je težko oceniti, kje ležijo razlogi za takšno dogajanje.

Namen magistrskega dela je bil identificirati glavne razloge za odstopanje rezultatov od zelenih in osvetliti področja, na katera se je potrebno v prihodnosti osredotočiti, da bodo pričakovani rezultati, v smislu točnosti dobav in logističnih stroškov, doseženi.

Cilj magistrskega dela je bil podati ključne iniciative za izboljšave, ki bi lahko pripeljale do zelenega rezultata oskrbovalne verige v prihodnje in bi vodstvu PPDO omogočile boljše izhodišče za odločanje o nadaljnjih korakih.

Za dosego zastavljenih ciljev sem uporabila **naslednje metode dela**. Začela sem z analitičnim pregledom literature in teoretičnih izhodišč na področju upravljanja oskrbovalnih verig. Nato sem analizirala trenutne prakse na področju upravljanja oskrbovalne verige PPDO, s pregledom dokumentacije nastale tokom projekta optimizacije oskrbovalne verige ter ostale interne dokumentacije. Nadaljevala sem z analizo trenutnih rezultatov delovanja oskrbovalne verige PPDO s pomočjo obstoječih kazalcev uspešnosti. Poleg tega sem izvedla vrsto intervjujev z odgovornimi procesnimi vodji. Na podlagi rezultatov analiz in pregleda teoretičnih izhodišč sem izdelala povzetek v obliki predlogov za izboljšave. Le ta so sem združila v področja strateškega vrednotenja dobavne verige, procesov, organizacije, sodelovanja med člani v dobavni verigi in kazalcev uspešnosti.

Po uvodnem delu so v **drugem poglavju** navedene glavne definicije oskrbovalne verige, menedžmenta, upravljanja oskrbovalne verige, ključni razlogi, ki privedejo podjetja, da se s tem ukvarjajo, ter glavne prednosti, ki jih zaradi tega imajo. Oskrbovalna veriga je set treh ali več enot (organizacij ali posameznikov) direktno vključenih v pretok blaga, storitev, sredstev in informacij od vira do končnega kupca. Aktiven menedžment je ključnega pomena za učinkovito delovanje oskrbovalne verige. To pa pomeni **planiranje** v smislu postavljanja ciljev, zamišljanja aktivnosti za doseganje teh ciljev kakor tudi oblikovanje ustreznih organizacijskih struktur, **vodenje** v smislu komuniciranja ciljev, delegiranja aktivnosti, in motiviranja ljudi, ter ne nazadnje tudi **kontrola** dosežkov in delovanja organizacije. Za doseganje racionalnega poslovanja je ključno **koordiniranje** aktivnosti in odpravljanje konfliktov ter sprejemanje ustreznih odločitev.

Z vidika oskrbovalne verige se to nanaša na vse njene člene. Sicer pa se definicije upravljanja oskrbovalne verige precej razlikujejo od avtorja do avtorja. V literaturi je upravljanje oskrbovalnih verig vse bolj prepoznano kot integracija ključnih procesov vzdolž oskrbovalne verige. V magistrskem delu sem se izmed procesnih modelov osredotočila predvsem na teoretična izhodišča SCOR modela (Supply Chain Operations Reference model). SCOR model definira pet ključnih procesov v oskrbovalni verigi, ki jih je potrebno integrirati, in sicer: planiranje, nabava, proizvodnja, dobava ter vračila. Z vidika PPDO je SCOR model najbolj zanimiv, saj je bil le ta osnova za implementacijo procesov v času projekta optimizacije oskrbovalne verige.

Literatura navaja tri glavne razloge, da se podjetja vse bolj ukvarjajo z upravljanjem oskrbovalne verige: neprestano povečevanje zahtev kupcev v smislu izboljšanih

storitev in zniževanja stroškov, vse večja pripravljenost za sodelovanje med organizacijami na področju izpolnitve naročila kupcev, ter razvoj informacijske tehnologije.

V teoretični okvir magistrske naloge sodi tudi model razvrščanja podjetij v različne stopnje zrelosti oskrbovalne verige, kot to definira svetovalno podjetje PRTM. Model obsega štiri stopnje zrelosti: od samo funkcijske organiziranosti na prvi stopnji, do popolne povezanosti procesov z zunanjimi partnerji na četrti stopnji. Seveda pa je stopnja zrelosti oskrbovalne verige povezana tudi s finančno uspešnostjo teh podjetij oziroma verig. Po raziskavi, ki jo je izvedlo raziskovalno podjetje PMG, so zrela podjetja 40% bolj dobičkonosna, njihovi skupni stroški oskrbovalne verige pa predstavljajo 9% delež v prometu, oziroma so 20% nižji kot v podjetjih z nižjo stopnjo zrelosti. Poleg tega, bolj razvite oskrbovalne verige lahko dobavijo izdelke 6 dni hitreje in izpolnjujejo kupčeve zahteve skoraj 100% pravočasno.

V **tretjem poglavju** so opredeljena teoretična izhodišča za strateško upravljanje oskrbovalne verige, povzeta po modelu Cohena. On pravi, da so ključne discipline za strateško upravljanje oskrbovalne verige strateško vrednotenje oskrbovalne verige, procesi, organizacija, sodelovanje med člani v oskrbovalni verigi in kazalci uspešnosti. Navedene discipline se zelo podobne definiciji menedžmenta, ki sem jo oblikovala za potrebe naloge in bazira na definicijah Rozmana, Pučka in nekaterih drugih avtorjev.

Če podjetje prepozna strateški pomen oskrbovalne verige, oblikuje oskrbovalno verigo okoli definiranih dejavnikov konkurenčnosti (kot so: inovativnost, nizki stroški, storitve, kakovost). Poleg tega podjetje razvije procese, ki tečejo vzdolž podjetij vpletenih v oskrbovalno verigo. S pomočjo informacijske tehnologije so podjetja in njihovi procesi tudi učinkovito integrirani.

Poleg tega je potrebno oblikovati organizacijo, ki bo učinkovito načrtovala in nadzirala procese znotraj oskrbovalne verige ter razvijala ključna znanja in sposobnosti, potrebna za izvedbo teh procesov. Za to je na eni strani potrebno dobro razumevanje ključnih kompetenc, potrebnih za doseganje konkurenčne prednosti na trgu. Z osredotočanjem na obvladovanje ključnih kompetenc podjetje povečuje svojo dobičkonosnost. Na drugi strani pa je potrebno za aktivnosti, ki niso definirane kot ključne kompetence, izbrati dolgoročne strateške partnerje.

Nenazadnje je ključnega pomena oblikovanje kazalcev uspešnosti, ki na eni strani merijo zdravje ključnih procesov, na drugi strani pa omogočajo učinkovito identifikacijo problemov.

V smislu vpliva oskrbovalne verige na poslovni rezultat je ena od ključnih sposobnosti podjetja ali oskrbovalne verige, da znižuje stroške. Druga ključna sposobnost je skrajševanje pretočnih časov in tretja, prilagajanje zahtevam trga. Najpogostejše ovire, ki se pojavijo pri uvajanju integriranega upravljanja oskrbovalne verige lahko strnemo v pomanjkanje vizije, slabo reševanje konfliktov, nekonsistentne operativne cilje, neustrezen pretok informacij, pomanjkanje resursov. Dejavniki, ki lahko pripomorejo k odpravljanju teh ovir, pa so: podpora višjega vodstva, zaupanje med deležniki, dobro postavljeni indikatorji uspešnosti, razgledani vodje, uporaba pilotnih projektov ipd.

Četrto poglavje podrobneje predstavlja predmet analize, torej skupino Danfoss, natančneje Poslovno Področje Daljinskega Ogrevanja (PPDO). PPDO je imelo v letu 2004 150 mio EUR prometa, v zadnjih dvanajstih letih pa v povprečju 21% rast. Rast je bila največja v zadnjih dveh letih zaradi številnih nakupov novih podjetij. Tako se je prodajni program iz komponent za daljinsko ogrevanje razširil tudi na pod-postaje in izmenjevalce toplote, ki predstavljajo že 41% celotnega prometa PPDO. Večina izdelkov se proda toplarnam 30%, nato pa sledijo trgovci na debelo in druge skupine kupcev. Glavni trg je še vedno Evropa s 74%, sledi Daljni Vzhod z 12% in Rusija z 8% vrednosti prometa. PPDO je organizirana procesno. Ključni procesi so: prodaja in marketing, razvoj in »operations«.

Vizija PPDO je postati globalni vodja na področju daljinskega ogrevanja z 10-15% letno rastjo in vodilno stroškovno pozicijo.

Glavne strategije za profitabilno rast so vstopanje na nove trge in nakupi novih podjetij, kakor tudi optimizacija proizvodnje in nabave, novi inovativni proizvodi in integracija oskrbovalne verige.

Analiza oskrbovalne verige PPDO, ki sledi v **petem poglavju**, je omejena na tisti del podjetij, ki so sestavljala oskrbovalno verigo v letih 2001-2002, ko je potekal projekt implementacije upravljanja oskrbovalne verige. To pa predvsem zato, da so rezultati primerljivi z originalno zastavljenimi cilji.

V ocenjevanju ključnih komponent za strateško upravljanje oskrbovalne verige, so ugotovitve sledeče: vse komponente, navedene v Cohenenovem modelu, so prisotne v okviru PPDO. Ugotovljeno je, da je na vseh področjih še prostor za izboljšave, predvsem na področju organizacije ter sistema spremljanja uspešnosti.

Analiza ključnih kazalcev uspešnosti in njene ugotovitve so predstavljene v **šestem poglavju**. Kazalci so postavljeni na štirih področjih: čas, stroški, storitve, kakovost. V primerjavi s postavljeno strukturo kazalcev uspešnosti v času implementacije integriranega upravljanja oskrbovalne verige, so le ti danes bistveno poenostavljeni.

Vodje posameznih procesov si želijo, da bi bil proces definiranja ključnih kazalcev uspešnosti bolj strukturiran, kar bi prispevalo k večji pripadnosti ciljem, kakor tudi boljšemu razumevanju le teh. Poleg tega pa je premalo poudarka na spremljanju odstopanj od zastavljenih ciljev in izvajanju aktivnosti za odpravo le teh. To so tudi poglobitni razlogi, da rezultati na področju zalog in logističnih stroškov niso bili doseženi. V tem delu so navedeni tudi rezultati primerjalne analize, ki jo je PPDO izvedlo leta 2004. Rezultati kažejo, da PPDO dosega primerljive finančne rezultate merjene v deležu stroškov prodanega blaga, kakor tudi na področju zagotavljanja točnosti dobav ob bistveno manj učinkoviti uporabi sredstev (zaloge).

Na podlagi rezultatov analiz v petem in šestem poglavju sem v **sedmem poglavju** povzela glavne prednosti in slabosti trenutnega stanja oskrbovalne verige PPDO ter podala predloge za izboljšave razvrščene v naslednje skupine: strateško vrednotenje oskrbovalne verige, procesi, organizacija, sodelovanje med člani v oskrbovalni verigi, kazalci uspešnosti po modelu Cohena. Glavne iniciative so ovrednotene glede na njihov vpliv na kazalec RONA po modelu Lewina.

Tako lahko rečemo, da je osnovni namen magistrske naloge dosežen, saj so bili identificirani glavni razlogi za odstopanja rezultatov od želenih. Na podlagi pregleda literature so bila izbrana nekatera teoretična izhodišča, ki služijo kot osnova za doseganje cilja naloge, ki je bil podati ključne iniciative za izboljšave, ki lahko pripeljejo do zelenega rezultata oskrbovalne verige v prihodnje.

Integrirano upravljanje oskrbovalne verige je torej temelj ta doseganje nadaljnjih izboljšav oskrbovalne verige. Magistrska naloga zaključuje z ugotovitvijo, da morajo biti glavni napor vodstva PPDO usmerjeni v pregled obstoječe strategije oskrbovalne verige, kot osnove za nadaljnjo standardizacijo procesov, v implementacijo jasne strukture odgovornosti po modelu RACI, v izbor ključnih partnerjev in nenazadnje v izboljšanje planiranja in kontrole oskrbovalne verige. Vse to lahko izboljša tako točnost dobav izdelkov na eni strani kot boljše obvladovanje stroškov na drugi strani in poveča kazalec RONA za okoli 10%. Naštete iniciative pa seveda zahtevajo osredotočenost na projekte, ki bi zagotavljali dosego teh ciljev ter veliko podporo vodstva.