DEMAND & SUPPLY CHAIN MANAGEMENT: A LOGISTICAL CHALLENGE

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Introduction

Consumers and industrial customers are demanding more and different products and services. The industry requires replenishment of small batches in high frequencies. The consumer asks for a broad assortment with fresh products, tenable qualities and short lead-times or direct deliverable. These developments in Business-to-Consumer (B2C) markets and Business to Business (B2B) markets can be illustrated by a number of different examples.

In recent years individual suppliers were successful to meet the requirements of their customers in an efficient and effective way. Depending on the innovative power there are differences between types of industry and their ability to satisfy their customers. In the meantime for most companies the individual flexibility and agility has reached a saturation level: high efforts and high costs have to be spent to satisfy customers' demands.

The rise of Demand –or Demand driven- and Supply Chain Management (DSCM) can be explained by the understanding that only combinations of companies are able to meet customer requirements in a more efficient and better way than individual companies can realize. Collaboration between suppliers, manufacturers and retailers can improve the number of satisfied customers by reducing lead-times, improving service levels and decreasing costs.

Customers and competitors force companies to co-operate with each other in one or more chains or networks. For some companies this way of co-operation is the last post to continue their existence. Other companies believe that DSCM is an enormous opportunity to redefine their missions and to introduce innovative types of constellations to meet customers demands on a high level in chaining market conditions.

This paper is distinguished in the next paragraphs:

Introduction
1. Partnership in supply chain
2. Demand & Supply
3. Four stages in SC Logistics
4. Research in FMCG
5. Pitfalls in partnerships
6. Trends
7. Conclusion

The need to collaborate can be illustrated by a statement of the Food Management Institute: 'To be a prime participant in the consumer replenishment process, requires a range of capabilities bigger than a single enterprise'. They expect the rise of a number of chains or networks in which an individual company only accounts for ' best of class', that means the contribution of activities in which the company is excellent. Although the design of a chain is the first strategic step, the implementation, planning and control and functioning of the chain are equal important steps. Or in terms of FMI: 'The dysfunctional supply chains of today cannot serve the consumer of 2005'. They distinguish a number of different chains, but are not satisfied about their operations. We conclude that both the design and the operations of a supply chain are closely related to be successful in the implementation of DSCM-concepts.

Positioning this paper, a broad logistics view on DSCM will be our focus. To illustrate this, top managers in recent surveys forecast the following trends in logistics and distribution:

- The scope of supply chain management will shift from national via European to global;
- Multimedia trends (the Internet, information technology, mobile communication) will bring about a revolutionary change in supply chain management;
- The negative effects of JIT deliveries (on the environment and on costs) will compel companies to develop new logistics concepts;
- A reallocation of tasks will occur within the supply chain;
- Management bodies of national sales organizations will see their power and influence decrease;
- Logistics restructuring projects will fail less often, but they will still require a great deal of time and yield lower savings than expected;
- Last but not least, customers will become increasingly critical and supply chain management will become increasingly important in the battlefield of competition.

Preliminary we conclude that Supply Chain Management is a trend and a solution for a number of the mentioned developments.

1. Partnership in supply chains

Handfield and Nichols (1999) argue that integrated supply chain management is becoming recognized as a core competitive strategy. As organizations continuously seek to provide their products and services to customers faster, cheaper and better than the competition, managers have come to realize that they cannot do it alone; rather, they must work on a cooperative basis with the best organizations in their supply chains in order to succeed.' The success of SCM will depend upon the choice of the specific partners in the supply chain and on the way in which they co-operate efficient and effective with each other.

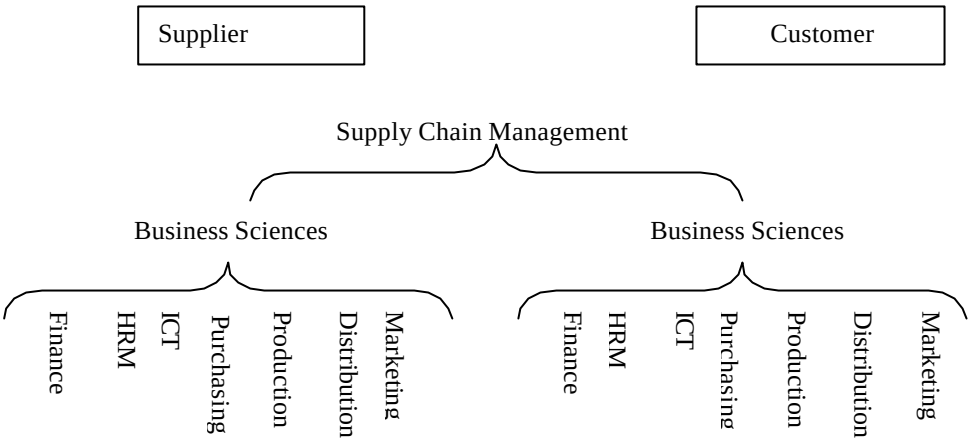
It cannot be denied that different functional areas try to satisfy customer demands as good as possible. Especially the marketing-function build a respectable reputation from this point of view. This customer orientated view is also underwritten from the customer service theory within the logistics function.

Unless this hopeful sign, we conclude that customer orientation is insufficient in a number of industry-types. Even within companies there exists a continuous battle between functional areas about customer responsibility: agreements with customers are frequently transferred from one function to another. In this respect we need to clarify the differences between Business Sciences (Bedrijfskunde) and Supply Chain Management.

In Business Sciences, the target is to integrate the different functional areas within one organization. The tuning of the policy of a Research & Development department on the policy of a marketing department has to be positioned as an example of a problem in Business Sciences. Another example regards the design of a financial administration that is equipped for the reporting on key performance indicators for the logistics function. About these types of functional integration within companies, a lot had been published and different studies like MBA exists.
Handfield and Nichols (1999, p. 153) conclude on Business Sciences that "functional capabilities (R&D, manufacturing, marketing, technology) are enablers for success, but are no longer sources of competitive advantages, because they can all be replicated in time. SCM provides a means to achieve a definitive competitive advantage."

Supply Chain Management broadens the scope: The integration of decisions within and between companies in a chain is the main mission. Information flows, financial flows and good flows have to be integrated from a multi-company point of view. This means that SCM regards the activities of functional management and of general management in each company. In other words: a manager can and may no longer restrict himself to the control of his own department or his own company. Functional and general managers have to be involved in the control of network relations in the direction of customers and suppliers. Depending on their starting point (market, logistics, purchasing or ICT) in literature a number of different definitions on SCM have been formulated (Gattorna, 1998).

With the help of figure 1 we try to statue the differences between Business Sciences and SCM. In that figure we talk about the generic customer-supplier relation. That can be situated as a relation between a packing supplier and an international label manufacturer. But also a relation between a logistics service provider and a retailer. In our formal definition on SCM we will argue that a supply chain is only defined when two interfaces are existent; for these interfaces at least three parties are necessary. As the basic principles of SCM can be illustrated by two parties, we restrict ourselves to that number, picturing figure 1.



From figure 1 we conclude that SCM regards the interface and the allocation of decisions between two or more companies. This can be illustrated by different types of definitions of SCM (Hoekstra, Romme, 1993).

3. Demand & Supply

According to our opinion the term Supply has a strong association with the idea that SCM regards the management of the relations with suppliers. From a customer point of view we propose to start with demand management. For almost every chain that means that chain conversion should be the leading theme.

In figure 2 we picture a classical supply chain: a strongly push-driven chain, mostly based on production dominance. Related to a pure marketing vision the demand chain in figure 3 may be more realistic.

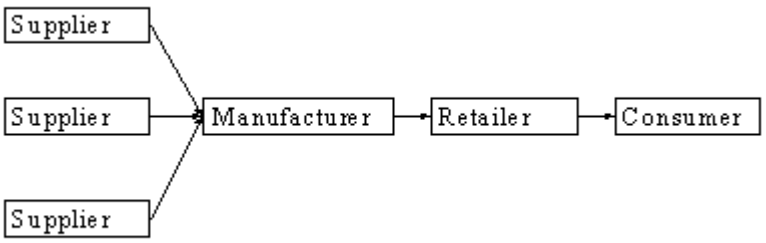


Figure 2 - A Supply Chain

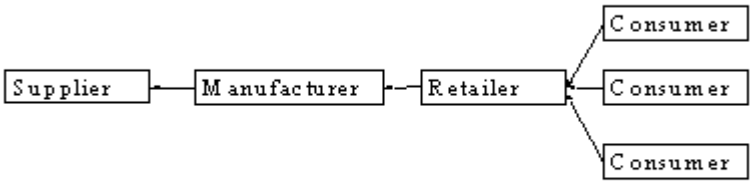


Figure 3 - A Demand Chain

This complete pull-driven chain can be too extreme. Based on this meaning, a combination will be the best representation of reality.

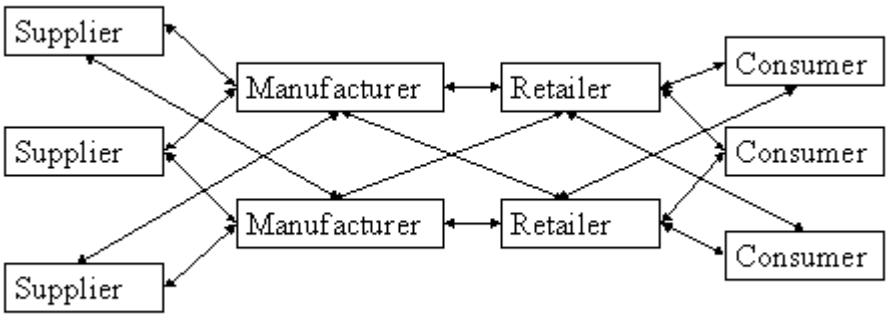


Figure 4 – A Demand and Supply Network

In figure 4 we present the Demand and Supply Network. We emphasis that this figure can be widened with logistics and ICT-service providers. Based on this idea the Center for Supply Chain Management of Nyenrode University has formulated the most embracing definition: "Demand and Supply Chain Management (DSCM) is the management of a network that links customers and suppliers as one 'single entity' with the objectives to create value and reduce waste through the voluntary integration and co-ordination of the objectives of three or more – and ideally, all the – independent parties in the network."

We shall give a short explanation of a number of elements in this definition.

- In terms of Hoekstra, Romme (1993) a chain is a logistical infrastructure with three nodes and two interfaces. Gladly most of the companies have more than one customer and usually also more than one supplier. Based on this statement a network-infrastructure will be more realistic than a chain structure. Regardless this vision, the term network-integration has a relative long history in the information technology with slightly different meanings compared with logistics. For this reason we persist to use the term chain integration, implicitly supposing that network integration is a better one.

- The management of a supply chain as a 'single entity' agrees with the definition of Jones & Riley (1985). Especially in the basic figure of Efficient Consumer Response, Kurt Salmon Associates (1993) emphasize that it regards the

destruction of the walls between the different trading partners. The decoupling of the different functions and partners by means of inventories has to be avoided. Besides our discussion on the differences between Business Sciences and SCM, ECR has given us an idea what we mean by managing the chain as a single entity.

- The creation of Consumer Value is a central theme since Porter (1985) introduced the term Value Chain. The creation of value has to be balanced with the efforts a company has to perform. Waste can be interpreted as the decrease in the spend thrift of raw materials, etc. but also in a broad sense as the reduction of costs in relation to revenues. By this we mean that a supply chain has to be efficient.

- Supply chain corporation does not include mergers and acquisitions. Co-operation in the chain is voluntary, but can never without commitment. The voluntary co-operation knows a variance of possibilities: from huge legal constructions to gentlemen agreements.

- Companies can participate in more than one chain. The consort of companies can be defined as a possible path through a detailed network.

We propose to concentrate Demand driven Supply Chain Management on the integration of four functional areas within and between companies. From the demand side it regards the marketing aspects of DSCM, while purchasing is the entrance from the supply side. Logistics and ICT are the essential facilitating functions for DSCM.
The four mentioned areas are according to our opinion the leading elements for the design, planning and implementation of a Demand and Supply chain (Ploos van Amstel, van Goor, 2002). Figure 5 is the representation of that vision. Research in the field of DSCM has to concentrate on the interfaces between the different points of view. For illustration purposes we restrict ourselves to some possible interfaces.

- Category management is an important integration concept between marketing and purchasing.
- E-commerce as part of E-business is a typical example of the rising interface between marketing and ICT
- Efficient Replenishment Upstream (ERU) is a co-operation between purchasing and logistics on a more intensive base than is the case until now.
- The application of Advanced Planning Systems (APS) is a fundamental subject for the integration between logistics and ICT from a real supply chain software vision.

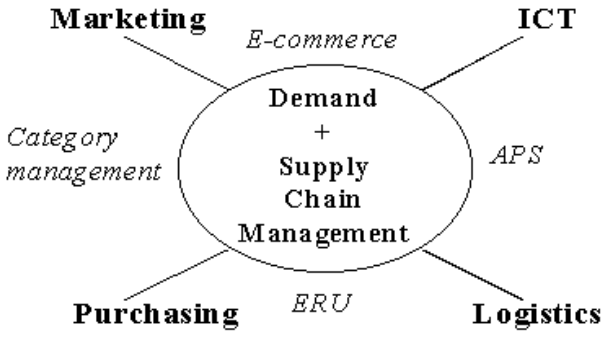


Figure 5 – DSCM viewpoints and interfaces

With these examples we finish our discussion on the different elements in the broad definition of Demand and Supply Chain Management.

4. Four stages in SC Logistics

Customer service is a process that transcends organisational boundaries, even those of the company itself. The customer distribution process is more likely to involve third-party logistics providers that perform certain activities in the supply chain: transport, storage, reconditioning, testing and even assembly. That is why companies in the supply chain strive to achieve strong co-operation in the supply chain, supply chain integration or supply chain management.

Supply chain management involves co-ordinating the logistical activities within the individual links of the logistics chain in such a way that the logistical processes can be managed and can function as an integrated whole, with the support of an integrated information system. The ultimate goal is to optimise the logistics performance of the complete supply chain.

Within the context of supply chain logistics, integration can occur at different levels:

(a.) Physical integration. The performance improvement of the primary process is the aim in this stage. Standardization of consumer and transportation packaging, pallets and roll-containers are examples of physical integration. In Europe 45% of the packaged goods are distributed on standard pallets (Europallet 80 x 120 cm) and in standard-boxes (40 x 60 x 40 cm). At the moment there is a strong tendency to replace corrugated board by multiple transportation systems (plastic boxes). The organisation of a pool-system for this multi-trip packaging system seems to be a critical success factor.

(b.) Information integration. In the second stage of integration the information flow with respect to the primary process is tuned between vendors and suppliers. Electronic Data Interchange (EDI) is a tool, but not a target at this stage. Breaking-points in information flows can be prevented by using these tools. The standardization of messages and barcodes are necessary but not sufficient conditions for information integration. Chain partners must be prepared to share the information that is needed to manage the chain as a single entity. Although logisticians usually agree with this statement, marketers are rather restricted for competitive reasons. So SCM is not only a form of education between suppliers and vendors, but also a means for breaking down the barriers between functional specialisms in each organisation.

(c.) Control integration. At this stage the physical flow is simultaneously managed at more than one level in a logistics chain. Time phased information facilitates the introduction of Distribution Resources Planning techniques. Quick Response and Vendor Managed Inventory are proved concepts in the control-stage of SCM. They are directed at improving sales and customer service in the retail store by rapidly responding to sales trends and improving in-store stock levels, while reducing inventory and replenishment time all along the supply chain. European retailers require a replenishment time of 18 hours between the Point- of Sale transaction and refilling the in-store stocks. Without an EDI-link it is impossible to realize the control-integration opportunities.

(d.) Structure integration. In the three previously discussed types of integration, the basic logistics structure is not a research subject. Only performance increases in the primary process, the control system or the information system are the targets. Structure-integration is a next step: Planning tasks and logistics responsibilities are delegated to another chain partner. In other words: one party takes over the logistics responsibilities within the territory of the other party. Although this can be the case by including a logistics service provider, it is not necessary to do so. Based on immense mutual confidence, examples of this type of integration are operational in the health care and office supply industries: traditional wholesalers operate the logistics functions within the walls of hospitals and insurance/banking companies. In other words: facility management is offered by the trade-partners.

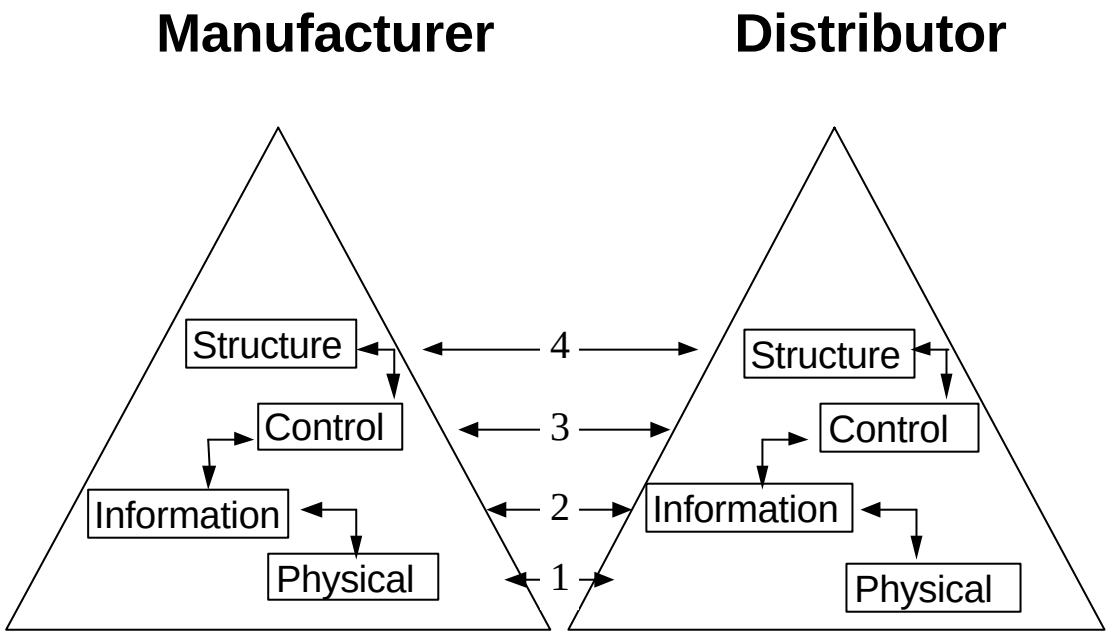


Figure 6 Four stages in supply chain logistics

The four stages of SCM are visualized in figure 6. There are many similarities between the elements of the logistics concept and the stages in supply chain integration.

Finally, supply chain management helps to increase customer satisfaction, and hence to increase the profitability of all the partners in the supply chain. By giving careful consideration to integration, new concepts can be generated such as supplier backhauling, replenishment, product modifications, standardised packaging modules, consolidating competitors' product flows (synergy in goods flow), taking over manufacturers' inventory functions, cross-docking, co-ordinating customer service levels with customers, pre-installation, delivery, installation, instruction by third-party logistics providers, more frequent order placement, smaller quantities per order, pre-packing for end customers, having suppliers handle barcode price labelling and automated replenishment, co-ordinating production planning and information technology, etc.

5. Research in FMCG

Most of the well known applications of SCM can be classified in one or more of our stages of integration. A preliminary conclusion is that the physical and information stages are operational on a large scale in U.S., European and Japanese companies. The applications of control and structure integration are rather scarce. So, we conclude that the value added through SCM can be attractive for all the traditional partners in a marketing channel. In most cases they operate with the help of service-providers.

In the FMCG-industry we performed empirical research to prepare an answer on two questions:

- Can a measure of success in DSCM be explained by the underlying factors in each of the in figure 6 mentioned stages in supply chain logistics?
- Is there a fixed schedule/standard sequence for a company to move from physical integration to structure configuration?

Based on empirical data from 30 national and multinational FMCG-companies we tried to answer the two mentioned questions.

In the study the success of supply chain logistics was defined as the way in which the logistical costs and/or the customer service level changed significantly due to co-operation in supply chains. A combination of cost reduction and service level was sampled in a report-mark. So the report-marks were the real independent variables to measure success.
From literature and empirical research a number of 56 variables were collected. These variables had or could have a direct or indirect influence on the level of success in supply chain logistics. Examples of these explaining variables are mentioned in table 1:

Internal variables
• Standardization of communication traffic
• Exchange of detailed forecasts
• Order-status tracking and tracing
• Use of logistics control systems
• Type of order picking/cross docking
• Situation of Order Penetration Point
Distribution Logistics
• Utilization level of transportation
• Number of distribution centers
• Frequency of replenishment day and night
• Tuning distribution packaging and pallets
• Standardization of materials handling equipment
Organizational aspects
• Management involvement
• Joint targets in a chain
• Shared information-technology
• Trust and risks between channel partners
• Presence of channel captain/central co-ordination

Table 1 – Possible explaining success variables

Factor analysis

Based on the data from the 30 FMCG-companies factor-analysis and chi-square analysis was performed (Koning, 1998). In factor-analysis the causality-problem is avoided. As a result four factors could be formulated:

1. Flexibility in volume, replenishment and lead time (á = 0.8050)
2. Inventory costs according to stock levels and interest percentage (á = 0.9348)
3. Reliability in order completeness and service-level (á = 0.8797)
4. Costs of transportation, warehousing and materials handling (á = 0.6385)

We conclude that all these factors are logistical oriented on a rather high level of aggregation. They can not be addressed to one or another type of supply chain integration.

Chi-square analysis

From an analysis of the sampled data with the help of the chi-square analysis five variables showed a significant (at 90% level) influence on the dependent variable, the success of supply chain co-operation, measured as a report-mark distributed over 5 groups. These variables are:

a. The (electronic) delivery of order-status information. It regards a kind of tracking and tracing in the production and distribution process. (P = .08258)
b. The sharing of information with suppliers and customers to improve the efficiency of the goods flow. (P = .05825)
c. The usage of ABC-costing (Dekker, van Goor, 2000) as decision support for logistical decisions. (P = .05192)
d. The opening hours of distribution centers, especially with regard to the reliability of time-vences during day and night. (P = .08529)
e. The utilization level of transport capacity, focused on they way in which Full Truck Loads (FTL) and Full Pallet Loads (FPL) can be realized. (P = .09726)

Although these variables are more specific -or in other words less general- than the results of the factor analysis, we persist to conclude that the differentiation of the results to the four levels of supply chain integration unfortunately could not be realized.

ECR Europe

In 1998 a number of ECR-projects between manufactures and retailers in the Netherlands has been researched. In table 2 the supply chain partners are categorized according to the four types of supply chain logistics, which we discussed in paragraph 4. We conclude that the structure pilots present an empty box. In the three other types of co-operation different subjects were discussed. We mention:

- In the physical integration projects, the introduction of a standardized distribution packaging related to the sizes of an Europallet, the tuning of colli-numbers and the number of layers on a pallet, the sort and segregation of pallets and the launching of a dolly were the main subjects.

- The introduction of EDI for order entry, invoicing and order picking, extended to the EAN 128 pallet labels and the exchange of real sales figures via EDI were the most important pilots in the area of information integration.
- In the sector of control integration Vendor Managed Inventories, based on sales figures and a certain amount of forecasting were the contents of the exercised case-studies (Waller, 1999).
- Although not available in the pilots of 1998, in more recent studies we relate structure integration explicitly to Collaborative Planning, Forecasting and Replenishment (CPFR).

Company	Physical	Information	Control	Stucture
Makro	X	X		
CPC	X	X		
Makro		X		
Nestle		X		
AH		X		
P&G	X	X	X	
Lever		X		
vEerd		X	X	
Johma		X	X	
Schuitema	X			
Stegeman	X			
Schuitema	X			
VdBergh	X			
De Boer	X		X	
Fr. Vlag	X		X	
De Boer	X			
Coca Cola	X			

Table 2. Positioning ECR-pilots

Qualitative research

To be able to differentiate between the levels of supply chain logistics and an attempt to answer the question on the schedule in the levels of supply chain co-operation, in 1999 we performed 20 interviews with logistics managers of mostly the same companies we contacted in the mentioned 1998 research. During the interviews manufacturers and retailers gave their opinions about the stages in the supply chain model. We describe some of the conclusions (Van Eert c.s. 2000):

- Structure integration is not per definition the ultimate goal for companies. Information or control integration can be the optimal form of co-operation for certain types of companies. That depends on their corporate missions.
- The four stages have no finish. New developments implicate that a company has to rethink each stage continuously. There is an dependency between stages (e.g. the introduction of a dolly by Coca-Cola has implications for the physical stage and the information stage (EAN 128) of integration.
- There is a difference between a pilot and a regular process. In the pilot some aspects can be skipped, while that's not accepted in a regular process. So started a pilot on VMI with a manual/fax data-interchange. The transition to a regular process made it necessary to feed VMI with EDI-data (information integration).

- For control and structure integration an optimal performance at physical and information level is a necessary condition.
- Physical integration and information integration are often simultaneously implemented. Even between two companies this can be efficient. For structure and control integration a certain critical mass is necessary.
- A much-mentioned remark is that the supply chain model behaves from simple to complex. Physical- and information integration are supposed to be simple, while control- and structure integration are perceived as far more complex. There exists a kind of natural frontier between the two pairs of integration.
- The supply chain model is a basic model. It has to be translated in a stepwise approach towards successful supply chain management.
- In figure 6 the pyramids should be capsized to illustrate the figural distance between companies in a chain. With physical integration trust between partners is in an embryonic stage. With the rise of co-operation trust increases until –at the stage of structure integration- the companies are strongly interrelated.

With regard to the question if there's a fixed sequence in the way in which companies accelerate supply chain co-operation, we conclude from this qualitative research that the supply chain model in figure 6 is a good representation of the daily practice. All respondents agree that the physical and information stages have to be fulfilled before a partnership can be launched in the area of control- and structure integration.

6. Pitfalls in Partnerships

Lee and Billington (1992) describe fourteen pitfalls in supply chain management. They emphasize that (central) control of (decentralized) inventories in the chain, will be the most promising area of supply chain-logistics. The author's pitfalls present corresponding opportunities for improvement. It is not necessary to duplicate their strategies. In general, partnership through SCM has the abilities to improve customer service, to increase flexibility, to shorten lead-times and to reduce logistics costs. To be more specific, our research shows a number of threats for chain partners and service providers. We summarize our findings.

* Confidence. To realize a maximum value added through partnership/SCM a 100 percent confidence should be enjoyed between chain partners. Openness with respect to performance-indicators and costs is a minimum condition to be successful in any kind of partnership. Although account-management and relation-marketing suppose the same prerequisites, in practice the real win-win-relations in commerce and logistics are rather scarce. This point dramatically obstructs the rise of partnerships.

* Internal performances. A thorough knowledge of the internal operation of a chain partner is a necessary condition for external co-operation. Each company should use it's hierarchy-of- performance indicators (De Leeuw c.s. 1999). There should be no discussion about the used attributes and parameters. Possibilities for external partnerships are frequently seized to distract the awareness for internal problems. The lack of these fundaments seems to be an important reason for failures in partnerships.

* Logistics knowledge. In a number of industries contract logistics is presented as the solution for non-core-business-activities of a manufacturer or distributor. Although it has proved to be a successful strategy in different industries, a lot of shippers misunderstand their positions. Shippers believe that they no longer have to invest in logistics knowledge. They believe that the service provider will deliver physical and knowledge services. We wish to emphasize that especially in cases of outsourcing, the logistics knowledge of a shipper should be more accurate than ever. Only in that way will he be able to fundamentally judge the performances of his service provider.

- Flexibility in production. Last but not least, the most threatening aspect for logistics service providers has to be mentioned. The last two stages of SCM (control and structure integration) suppose a very familiar relation between vendors and suppliers or distributors and manufacturers. Based on perfect market information a manufacturer can produce in an optimal way. This may lead him to invest in maximum flexibility in his machines. Queuing-times and recondition-times are reduced to minor sizes and the production lead-time becomes as short as possible. In that situation the order-penetration-point: make to order replaces the policy of make to stock. There no longer is a disconnection between sales and production. Inventories of finished products become a characteristic of past situations. Efficient Consumer Response can be realized directly from the production-lines. Warehouses for finished products are only needed in cases of seasonal or promotional products. For all other products (central or regional) depots will only be used as grouping or transit centres. As in past times, the service provider will only function as a trucking firm. We believe that this scenario can be rather dangerous for the existence of logistics service providers.

7. Trends

To conclude this paper we mention a number of trends we observe in the supply chain environment.

- Collaborative Planning and Forecasting. In 2001 ECR Europe added CPFR as the 15th improvement concept to the ECR toolbox. Replenishment is extended from real sales figures to the exchange of forecasts and trends between partners.
- Strategic Pricing. Logistical aspects become more and more important aspects of companies pricing policy. Well known is the example between Campbell Soup and the U.S. retailer Wegmans. For 'optimal' logistic orders Wegmans receives a discount of $0.10 per case. For suboptimal orders Wegmans pays a penalty of $0.50 per case.
- Scan based trading. With the introduction of VMI the Toyota-habits become realistic for downstream situations in a number of chains. Suppliers are paid at the moment that the customer pays the supplier's client. This can result in amazing changes in the way companies have to finance their inventories and production or distribution activities.
- E-logistics. The E-commerce boom risks being halted by a logistics chaos. This means that E-business until now is too much front-office oriented. To be a reliable partner companies should emphasize more on their back-office activities. Especially E-fulfilment is a critical success factor.
- Multi Vendor Consolidation. Besides the well-known pitfalls: win-win relations, trust, openness, and clear internal and external figures among costs and service

levels, one of the biggest problems in DSCM are the decreasing sizes and increasing replenishment frequencies of the different goods flows.
In our current research in FMCG we have the intention to calculate the consequences of this phenomena in an number of different scenario's:
the contribution of logistics service providers
the revival of the wholesale function
the category delivery by joint manufacturers
the joint exploitation of retail infrastructures
We hope that in the second half of 2001 the preliminary results of this scenario-research will be available.

Conclusion

We believe that Demand driven Supply Chain Management is an amazing challenge for companies to satisfy their customers in a better way. In this paper we discussed the logistical view on DSCM. A four stage integration model seems to be realistic for the FMCG-industry. What's happening in FMCG will happen within five years in other types of industry. So we think that the developed logistics model is applicable on a industry wide scale. The dilution of goods flows is one of the biggest problems in DSCM. This problem reaches his top in the area of E-fulfilment. For that reason we formulate the statement that also E-logistics can learn a lot of the experiences within DSCM. So we conclude that DSCM is really a broad logistical challenge!

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