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# SUPPLY CHAIN DESIGN AND DIFFERENTIATION

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*Purpose: The purpose of this research is to develop a framework for differentiation focused supply chain design (SCD).*

*Design/methodology/approach: The framework has been developed based on a literature review and tested against a case study. Empirical data has been collected mainly from in-depth and semi-structured interviews.*

*Findings: Differentiation focused SCD can be organized into a five-stage process. It is essential that this process is aligned with new product development (NPD), such that they exchange information, and operate from the same segmentation model.*

*Research limitations/implications: The research is explorative in nature thus empirical data from other research settings should be gathered to reinforce the validity of the findings.*

*Practical implications: This research provides researchers and practitioners with insights as to how a differentiated supply chain should be developed.*

*Originality/value: This research contributes by addressing the lack of research examining how a differentiated supply chain can be developed.*

*Keywords: Supply chain management, strategy, differentiation.*

*Paper type: Case study*

## INTRODUCTION

Competitive and fragmented markets force companies to pursue rapid innovation, where new products are introduced at an ever-increasing pace (Carillo and Franza, 2006). The principal reason for this is the continuously shortening product life cycles, which companies need to follow, lest they be stuck with obsolete products (Zacharia, 2001). Other reasons are that first-to-market products may command higher initial prices, and also lead to a dominant market position, while reduction of the time-to-market (TTM) may result in major cost reductions (Droge et al., 2000). Furthermore, recently introduced products claim a growing share of companies total revenue, in many markets amounting to 40 percent or more (Handfield and Hichols, 2002). Therefore, many companies consider rapid and innovative new product development (NPD) as a key strategic activity, and TTM reduction as a key to long-term success and profitability.

In the approach above, the value or demand generating side of the company is emphasized, while the supply side is completely ignored. This may be a grave mistake, since it is well known that physical distribution plays an important role in value creation. As early as 1972, Christopher (1972) showed that physical distribution may create competitive advantage by adding customer value to the product. Competitiveness is therefore not solely based on offering desirable products (e.g., innovative, customized, and affordable), but also relies on customer service (supply chain capabilities). This is particularly the situation in markets where there is a trend towards commoditization. In these markets, it is critical to enhance overall customer value by providing tailored customer service through the development of a differentiated supply chain (Jüttner et al., 2007).

The previous debate within the supply chain design (SCD) field has centered on the ability of the supply chain to be either “lean” (Womack and Jones, 1996) or “agile” (Goldman et al., 1995). Since companies offer a variety of products to many different markets, it may not be suitable to fit an entire supply chain within a “lean” or “agile” context. Instead, it may be better to identify separate value streams, and to configure these independently. This type of solution is not well explored, but may prove fruitful, especially when considering fragmented markets (Hilletofth, 2009). This means that research seeking to increase the understanding of supply chain differentiation is needed (Kemppainen and Vepsalaninen, 2007).

The purpose of this research is to develop a framework for differentiation focused supply chain design. The framework has been developed using a literature review and case study approach. In essence, the proposed framework has been developed based on the literature review and tested against the case study. The case study describes SCD at two Swedish companies; one from the appliance industry (called Alpha for anonymity) and the other from the furniture industry (called Beta for anonymity), both having a significant international presence. Empirical data has been collected during the five-year period of 2006-2010, mainly from in-depth and semi-structured interviews with key persons representing senior and middle management in the case companies.

## **LITERATURE REVIEW**

A number of classification models have been proposed in the literature to guide the choice of supply chain strategy (e.g., Fisher, 1997; Christopher, 2000; Christopher et al., 2006; Mason-Jones et al., 2000). One of the first and probably one of the most cited models of supply chain strategy selection is Fisher’s (1997) model on how type of product influences supply chain design. In this model, products are classified as either functional (standard) or innovative (special). Innovative products refer to products with low volume and erratic demand, short life cycles, and possibly a high level of customization. In contrast, functional product refers to a product with a more stable demand, longer life cycle, and with little or no customization. Fisher suggests that functional products should be supplied with efficient (lean) supply chains while innovative products should be supplied with responsive (agile) supply chains.

A second model of supply chain strategy selection is the one proposed by Mason-Jones et al. (2000). In this model, which is primarily based on Hill’s (1993) research on manufacturing strategy, markets are classified according to the required market qualifiers and market winners. The theory specifies that the minimum requirements for competing in a market (market qualifiers) and the specific requirements for winning an order (market winners) both must be understood and applied to capture a share of the market. The definition of market qualifiers and market winners determine how an appropriate supply chain should be specified; hence, the supply chain should be tailored to match the required “winning criteria” of the market. It is argued that the lean supply chain is most powerful when cost is the order winner, while the agile supply chain is most powerful when service is the market winner.

A third model of supply chain strategy selection is the one proposed by Christopher (2000). In this model, markets (also applicable to products and customers) are classified according to three parameters: volume, variety, and variability. However, since variety and variability tend to be related, the typology is simplified into two dimensions. It is suggested that the lean supply chain is most powerful in markets where demand is relatively stable, and therefore predictable, and variety is low, while the agile supply chain is most powerful in markets

where demand is volatile and the customer requirements for variety are high. One limitation of this model is that it does not address all possible groups of the market segmentation.

A final model, and the most recent one, is the one proposed by Christopher et al. (2006). In this model, markets (or products, or customers) are classified according to three parameters: type of product (standard or special); type of demand (stable or volatile); and replenishment lead-time (short or long). “Special products” refers to products with low volume and erratic demand, a short life cycle, and possibly a high level of customization. In contrast, “standard products” refers to a product with a more stable demand, longer life cycle, and with no or limited customization. The authors argue that replenishment lead-time has to be included in any useful typology for supply chain strategy selection, due to its critical influence on responsiveness; this is particularly important, since globalization tends to extend lead-times. Since predictability often is related to type of product, i.e. standard products have stable and predictable demand, it is possible to simplify the typology to only two dimensions: predictability and replenishment lead-times.

The model suggests that there are four possible generic supply chain approaches. First, when demand is predictable and replenishment lead-times are short, a lean continuous replenishment approach is appropriate. In contrast, when demand is unpredictable and replenishment lead-times are long, a lean-agile hybrid (leagile) supply chain is befitting. When lead-times are long and demand is predictable, a lean supply chain is appropriate, for example, make and source ahead of demand in the most efficient way. Finally, when demand is unpredictable and lead-times are short, an agile supply chain, based on rapid response, is required. In addition, Christopher et al. (2006) argue that within each approach, the tactics adopted can also be influenced by whether the product is “standard” or “special”. For example, in the postponement cell for a special product, we may postpone manufacturing, but for a standard product, it could be better to postpone distribution (Pagh and Cooper, 1998).

## **FRAMEWORK**

It can be argued that differentiation focused SCD can be organized into a process of five stages: market segmentation, market understanding, as well as specification, selection, and implementation of supply chain solutions (Chopra and Meindl, 2010; Christopher, 2005; Hilletofth, 2009). In essence, the first four stages of the SCD process concern strategy formulation, while the last stage of the process concerns strategy implementation. This process should be initiated when a new product (or product category) is in the process of being developed. It is important that the SCD process is addressed in parallel with the NPD process (Pero et al., 2010; 2006; Van Hoek and Chapman, 2007), and that information is exchanged between these processes, for example, through the involvement of supply chain representatives in the NPD process (Hilletofth and Eriksson, 2011).

In the first stage of the differentiation focused SCD process (market segmentation), the objective is to develop a segmentation model based on those parameters that affect the selection of the most appropriate supply chain solution. It is important to collaborate with marketing, since the segmentation model should preferably be developed on the basis of market knowledge gained from market intelligence (Hilletofth, 2011). It can be argued that the SCD process should be directed on the basis of the same segmentation model as the NPD process. This is because these processes should have the same goal, satisfying the customers, as well as a common view of customer needs and requirements, in order to create a customer-oriented business. Consequently, this requires that these processes are directed on the basis of

a common segmentation model, preferably a needs-based segmentation model, where customers are grouped into different market segments based on the similarity of needs and benefits sought by the customers (Best, 2005). The overall segmentation model needs to be adapted with regard to the included information for each type of process. It is important to note that this stage is not conducted each time the process is initiated; instead, the company should develop a segmentation model and evaluate it continuously. However, the target is always one or more of the specified market segments.

In the second stage of the differentiation focused SCD process (market understanding), the objective is to identify how the different market segments, within the segmentation model, want to acquire a particular product, or, in other words, identify the preferred supply chain solutions. It is important to note that each market segment may require more than one supply chain solution. Sometimes a product is only intended for a particular market segment within the segmentation model, the investigation is then restricted to this segment. Collaboration with marketing is important, as the required information should be gathered through market intelligence. It is also crucial because marketing has the knowledge and skills regarding how customer needs are identified and how customer value is created.

In the third stage of the differentiation focused SCD process (specification of supply chain solutions), the objective is to specify all the solutions that can be provided cost-efficiently, or in other words identify the capabilities needed to serve the market. First, the capabilities of the sourcing, production, and distribution systems (existing and possible through investment) are defined. Then, the possible supply chain solutions are specified. This is a matter of choosing an appropriate manufacturing strategy and combining it with a suitable sourcing and distribution strategy. By combining relatively few strategies, it is possible to develop several differentiated supply chain solutions. The type of manufacturing strategy chosen determines whether the different supply chain activities are best managed according to lean or agile principles.

In the fourth stage of the differentiation focused SCD process (selection of supply chain solutions), the objective is to select the supply chain solutions necessary to satisfy most customers within each market segment. It may be necessary to utilize several supply chain solutions for each segment, to satisfy most of the customers (Hilletoft, 2009). However, it is important to note that each solution may be used in several segments as well as for other products. The number of utilized supply chain solutions is normally a question of finding a balance between customer satisfaction and cost-efficiency. However, this equation could be made more favorable by using differentiated service prices, based on cost-to-serve, in the supply chain solutions provided. In this case, it is a matter of finding a balance between revenues and costs.

In the final stage of the differentiation focused SCD process (implementation of supply chain solutions), the objective is to implement the selected supply chain solutions. If the company proceeds with implementation, it will face its highest costs to date (Chopra and Meindl, 2010). Sometimes a new product will only utilize existing supply chain capabilities and solutions, consequently, implementation, in such a case, concerns ramp-up of the supply processes. Other times, new supply chain capabilities and solutions have been selected and thus need to be developed. Accordingly, the scope of this stage can vary greatly.

## CASE STUDY

In this section the case study is presented. The case study includes two companies who have begun to develop a process for differentiation focused SCD. The case companies were chosen for their similarity in business strategy, i.e. to be customer-oriented; for the diverse nature of their industries; and for their position within the industry. Alpha operates in a fast moving appliance industry and holds a leading position (top three) in its market. It aims to combine cost-efficient production in low-cost countries with manufacturing as close as possible to major final markets. In reality, it has come to focus on increasing the number of products produced in low-cost countries. Beta operates in a slow moving furniture industry and its performance is mediocre when compared with its competitors. It aims to combine cost-efficient production in China with final assembly and warehousing close to the consumption market. The required data has been collected during the five-year period of 2006-2010, mainly from in-depth and semi-structured interviews with key persons representing senior and middle management in the case companies.

Alpha conducts business with retailers, who sell its products to customers. In addition, the company does business with direct suppliers. Alpha has chosen to carry out all manufacturing, assembly, warehousing, and distribution operations in-house, and is currently using three supply chain strategies. For standard products with short customer required lead-time, Alpha uses two lean supply chain strategies, based on the manufacturing strategies MTS and DTO. This means that the case company, based on forecasts and speculations, performs all supply chain operations, including sourcing, manufacturing, assembly, packaging, labeling, and distribution (not included in DTO approach), before it has received any customer orders. In both of these supply chain configurations, Alpha focuses on operational efficiency. For customized and more complex products, Alpha employs a leagile supply chain strategy, based on the MTO manufacturing strategy. This means that the design and sourcing processes are decoupled from the production, assembly, and distribution processes. In other words, production, assembly, and distribution activities do not occur before customer orders are received. The activities performed after orders are received (downstream of the COP) are managed according to agile principles, while activities performed before orders are received (upstream of the COP) are managed according to lean principles.

Beta conducts business with retailers, who sell its products to customers. In addition, the company does business with direct suppliers. Beta has chosen to outsource all manufacturing thus the suppliers could be regarded as manufacturers in the supply chain. The manufacturers are responsible for sourcing raw materials and components. Depending on the type of furniture and strategy, labeling and assembly may be done by manufacturers, Beta, retailers, or the customers. Packaging takes place at the manufacturer and sometimes also at Beta. The case company is in charge of transport to the retailers, and the retailers are responsible for the delivery to the customers. The company has separated its supply chain into two main groups, key account and private label. Key account orders are full containers shipped directly to the customer (about 4 % of the total number of containers). Manufacturers are responsible for the sourcing, and it is hard to trace if materials are sourced before (MTO) or after the order is placed (STO). Private label is always shipped to Beta's warehouse. The product type determines if it should be delivered complete (MTS), or as components that are to be assembled at Beta's facilities (ATO). Key account is performed without any speculation. The contribution margins for these products are low and thus efficient supply chain operations is a necessity. Private label products are ordered based on forecasts and speculations. This supply chain has a strict focus on operational efficiency and unit cost. After a customer order is

placed at the retailer, a fast responding approach is used to either deliver (MTS), or to assemble and deliver products (ATO). In essence, this is a lean approach, meaning that final assembly and distribution are postponed until a customer places an order. Activities performed after orders are received (downstream of the COP) are managed according to agile principles, while activities performed before orders are received (upstream of the COP) are managed from lean principles.

Both the case companies have begun to develop a process for differentiation focused SCD very similar to one another as well as to the framework proposed in this paper. In essence, the overall stages of the case companies processes are the same with some minor variances within them. The SCD process consist of three stages:

- Understanding the market we serve
- Understanding the capabilities to serve the market
- Developing the necessary supply chain solutions

In the first stage, the case companies try to understand the market they serve by identifying how customers, via retailers, want to acquire products. This is achieved through market intelligence, where important information that may affect the companies' service to the retailers is collected. Many strategic considerations need to be made regarding the retailers. Both Alpha and Beta considers a number of characteristics before deciding how to serve the retailers, such as product range, required lead-time, location, and volumes.

In the second stage, the case companies try to understand their capabilities to serve the market. This involves defining the production and delivery system capabilities. It is essential to understand the capability of the production system to produce according to demand, and the capability of the distribution system to deliver the output to customers. Apart from this, a secure supply of raw materials and components is important for the stability and reliability in manufacturing. This activity differs a bit between the case companies due to the level of outsourcing in manufacturing. In essence, it concerns whether the production system includes internal or external actors, or both.

In the final stage, the case companies identify suitable approaches to serve the customers via the retailers, commonly referred to as supply chain solutions. A supply chain solution matches a supply method, reflecting the production system capabilities, with a delivery method, reflecting the delivery system capabilities. Alpha believes that combining supply and delivery methods into various supply chain solutions creates a differentiation advantage through freedom of choice, while at the same time maintaining the efficiency of operations in the production and distribution systems. Beta has found it necessary to combine several supply and delivery methods to provide the best solution for the whole supply chain and at the same time to maintain operational efficiency in production and delivery. There may be more than one solution chosen for each customer. For example, Alpha may supply both own label products and private labels at the same retail outlet.

In both case companies the SCD process is directed based on a segmentation model. In these segmentation models the customers are grouped into different market segments based on the similarity of needs and benefits sought by the customer (Best, 2005). When the SCD process is initiated the target is always one or more of the included segments. The model is not developed each time the process is initiated but continuously evaluated. When the three stages have been conducted the implementation starts. Consequently it may be argued that

their SCD processes consist of five stages, very similar to the proposed framework. Still, it is important to note that some of the important considerations explained in the framework are not considered in the case companies. For example, the collaboration between supply chain and marketing is low.

### **CONCLUSION**

This research suggests that differentiation focused SCD can be organized into a five-stage process. In the first stage (market segmentation), the goal is to develop a segmentation model based on the parameters that are required to identify an appropriate supply chain solution. In the second stage (market understanding), the goal is to identify how different market segments want to acquire the particular product (identify the wanted supply chain solutions). In the third stage (specification of supply chain solutions), the goal is to specify the supply chain solutions that can be implemented cost-efficiently (identify the capabilities to serve the market). In the fourth stage (selection of supply chain solutions), the goal is to select the supply chain solutions necessary to satisfy most customers within each market segment. In the fifth and final stage (implementation of supply chain solutions), the goal is to implement and prepare the selected supply chain solutions. This SCD process should be initiated when a new product category is being developed. It is also important that SCD is addressed in parallel with the NPD process, that information is exchanged between them, and that they are directed on the basis of the same segmentation model. An interesting area for further research is to continue examining how a differentiated supply chain can be developed, implemented, and managed. A differentiation focused supply chain design process has been proposed in this research. However, this matter needs to be investigated further and the scope of the research should be extended to include implementation and managerial aspects as well.

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