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Citation for the original published paper (version of record):

Hilletoft, P., Eriksson, D. (2011)

Coordinating new product development with supply chain management.

Industrial management + data systems, 111(2): 264-281

<https://doi.org/10.1108/02635571111115173>

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-19680>

Coordinating new product development with supply chain management

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Abstract

Purpose: This research seeks to form an understanding of how new product development (NPD) relates to supply chain management (SCM), why the two fields should be coordinated, and how this may be done.

Design/methodology/approach: This research uses a literature review and case study research. The case study considers a Swedish company that operates on a global basis in the furniture industry. Empirical data has been collected mainly from in-depth interviews with key persons representing senior and middle management in the case company.

Findings: This research stresses the need to produce innovative, value-adding products, as well as the necessity to quickly deliver them to the market. Companies that face mature business environments may encounter problems due to a high emphasis on either the value creation processes, or on the value delivery processes. Therefore, NPD activities need to be coordinated with SCM activities on a strategic level, lest competitiveness will be lost.

Research limitations/implications: The research is limited to one case company; replication studies would enhance understanding of the studied phenomenon. There is a wide need for research exploring how various parts of demand and supply chains should be managed in order to fully utilize the advantages of the consumer-oriented enterprise.

Practical implications: This research provides insights for researchers and practitioners on how to coordinate and balance NPD (demand-side) with SCM (supply-side) activities. It highlights that companies should organize themselves around understanding how consumer value is created and how these processes may be coordinated to provide that value. The two processes must be given equal attention and importance to avoid sub-optimization.

Originality/value: The need for coordinating NPD and SCM activities has been emphasized in the literature but still remains relatively unexplored. This research contributes by investigating this issue further.

Keywords: New product development; Supply chain management, Furniture industry, Sweden

Paper type: Case study

1. Introduction

Many companies consider new product development (NPD) as a key strategic activity and a short time to market (TTM) as critical to long-term success. The majority of research in this field has focused on issues such as reduction of the TTM and process improvement issues in isolation (e.g., Cohen et al., 2000; Gerwin and Barrowman, 2002; Morgan et al., 2001). However, research addressing the coordination of NPD and supply chain management (SCM) as necessary for bringing new products to the market is relatively rare (Carillo and Franza, 2006; van Hoek and Chapman, 2007). For instance, Krishnan and Ulrich (2001) comment that the literature addressing NPD and production ramp-up is sparse, although notable

exceptions exist (e.g., Terwiesch and Bohn, 2001; Terwiesch and Xu, 2001; Terwiesch et al., 2001).

The lack of research addressing NPD and SCM coordination is remarkable, since the TTM is affected by numerous SCM activities. It may be argued that the NPD process not only enables management to coordinate the flow of new products efficiently, but also to assist in the ramp-up of supply processes and other related activities (e.g. marketing and sales), that support the commercialization of the product (Carillo and Franza, 2006). For this reason, companies need to stop thinking around the edges and begin to coordinate and address these issues in parallel to reduce the TTM as well as to enhance profitability (Van Hoek and Chapman, 2006). SCM should no longer need to clean up after NPD, but instead be involved from the beginning of product development, with the same level of authority (Van Hoek and Chapman, 2007). There is a lack of research examining how the different NPD and SCM activities influence each other, how they can be coordinated, what benefits that can be obtained by coordinating them, and what the requirements are to succeed with the coordination (Carillo and Franza, 2006; Van Hoek and Chapman, 2006; Van Hoek and Chapman, 2007). This means that there is a need for research aiming to increase the understanding of the whys and hows of NPD and SCM coordination.

The purpose of this research is to form an understanding of how NPD is connected to SCM. The research questions are ‘what linkages exist between new product development and supply chain management?’ and ‘how should these processes be coordinated?’. The study primarily focuses on NPD success factors, with connections to SCM then being derived from these success factors. The issue has been examined through a literature review and a case study from a Swedish company that operates internationally in the furniture industry (to retain anonymity called Alpha). The research is part of an embedded single case study (Yin, 2009), aimed at investigating a consumer driven company. Empirical data has been collected from several sources during the four year period of 2009-2010. The remainder of this paper is structured as follows: A literature review of NPD related issues are presented in Section 2. After that, the case study is presented and analyzed in Section 3. Finally, the research is discussed and concluded in Section 4.

2. Literature review

In this section previous research on the coordination between NPD and SCM is presented first. Thereafter a literature review of important NPD success factors is given.

2.1 *Coordination of NPD and SCM*

It is well recognized that the NPD process not only enables management to coordinate the flow of new products efficiently, but also to assist in the ramp-up of sourcing, manufacturing, distribution, and other sales-related activities that support the commercialization of the product (Carillo and Franza, 2006). Therefore, the traditional NPD functions must be coordinated with the support functions (Hilletoft et al., 2009; Van Hoek and Chapman, 2007).

Companies tend to use a fairly conventional approach to NPD by assigning representatives from support functions to review and recommend changes as the project evolves (Kotler et

al., 2009). This conventional approach to NPD has in recent years been questioned, since it is a costly and time-consuming approach due to its iterative nature (Sharifi et al., 2006). It is argued that the TTM and the cost of NPD can be reduced considerably by involving the support functions to a greater extent, and also earlier in the NPD process (Carillo and Franza, 2006; Van Hoek and Chapman, 2006).

New practices have emerged in the area of NPD to address this lead-time issue (Sharifi et al., 2006). One of these practices is concurrent design or engineering, which involves a multi-functional development team (Portioli-Staudacher et al., 2003). This development team is highly structured and infused with greater responsibility and authority (Appelqvist et al., 2004). However, concurrent design has mostly focused on internal collaboration while today's global competition may require for concurrent design to be a collaboration in the entire demand-supply chain, as it is an important key to success and profitability.

The terms "design for manufacturing" and "design for supply chain" are quite often used to imply that the traditional NPD functions are aligned and coordinated with other main functions in the company and in the extended enterprise (Appelqvist et al., 2004; Ellram et al., 2007; Perks et al., 2005; Sharifi et al., 2006; Sharifi and Pawar, 2002). Hence, it may be argued that multi-functional, or cross-functional, NPD teams should be seen as a component of NPD (Kotler et al., 2009).

2.2 NPD success factors

NPD is no easy task, with new product introductions failing at a disturbing rate. Recent studies found the rate being as high as 50 percent, and potentially as high as 95 percent in the United States and 90 percent in Europe (Ogama and Pillar, 2006). In Table 1, a summary of NPD success factors identified in the literature is presented. As can be noted, NPD success may result from numerous reasons arising from market, product, strategy, and process characteristics.

The competitive response intensity, market potential, product life cycle length, and the competitor's aggressiveness are four market characteristics that affect the success of new products (e.g., Cheng and Shiu, 2008; Cooper et al., 2004; Henard and Szymanski, 2001; Kotler et al., 2009). The market potential may be seen as the total opportunity to make business. The length of the opportunity is restricted by the lifetime of the offered product, the width of the opportunity is reduced by competitors' aggressiveness, and the competitive response intensity reduces both the width and breadth of the opportunity.

The value advantage, price, technological sophistication, and innovativeness of the product are common product characteristics that affect the success of the product (e.g., Cheng and Shiu, 2008; Cooper et al., 2004; Droge et al., 2008; Hamm and Symonds, 2006; Henard and Szymanski, 2001; Kotler et al., 2009; Van Kleef et al., 2005). In essence, it is the consumer perceived value, in contrast to the consumer perceived cost, which determines what product characteristics are important for success.

Common strategy characteristics that impinge on the success of a new product are marketing and technological synergy, dedicated human and R&D resources, market timing, fit with organizational culture, and brand power (e.g., Carillo and Franza, 2006; Cheng and Shiu, 2008; Cooper and Kleinschmidt, 1986; Dowling and Helm, 2006; Gerwin and

Barrowman, 2002; Hamm and Symonds, 2006; Henard and Szymanski, 2001). Market synergy means congruency between the existing marketing skills of the firm and the marketing skills needed to serve the market, while technological synergy means congruency between the existing technological skills of the firm and the technological skills needed to develop desirable products and efficient processes. Brand power is connected to the value that the name of the brand adds to the product. Branding is often used to attract, and retain customers.

Table 1 New product development success factors

Success factors	References
Market characteristics - Competitive response intensity - Market potential - Product life cycle length - Competitors' aggressiveness	Cheng and Shiu (2008), Cooper et al. (2004), Henard and Szymanski (2001), Jain (2001), and Kotler et al. (2009).
Product characteristics - Product advantage (unique/superior product) - Product meets customer needs - Product price - Product technological sophistication - Product innovativeness	Cheng and Shiu (2008), Cooper et al. (2004), Droge et al. (2008), Hamm and Symonds (2006), Henard and Szymanski (2001), Jain (2001), Kotler et al. (2009), and Van Kleef et al. (2005).
Strategy characteristics - Marketing synergy - Technological synergy - Order of entry (timing) - Dedicated human resources - Dedicated R&D resources - Fit with the organization's culture - Brand power	Carillo and Franza (2006), Cheng and Shiu (2008), Cooper et al. (2004), Cooper and Kleinschmidt (1986), Dowling and Helm (2006), Gerwin and Barrowman (2002), Hamm and Symonds (2006), Henard and Szymanski (2001), Karlsson and Åhlström (1996), Kotler et al. (2009), and Lummus and Vokurka (1999).
Process characteristics - Strategic and holistic view - Structured approach - Market/customer oriented - Project-oriented - Team-based (instead of group of experts) - Cross-functional (concurrent design) - Segmentation-based - Market intelligence driven - Proficiency of the NDP activities - Technological proficiency - Reduced lead-time (responsiveness) - Cooperation with suppliers and customers - Information technology support - Senior management involvement	Barczak et al. (2009), Carillo and Franza (2006), Cheng and Shiu (2008), Ciappei and Simoni (2005), Cooper (1990), Cooper and Kleinschmidt (1986), Cooper et al. (2004), Droge et al. (2008), Gerwin and Barrowman (2002), Gupta and Wilemon (1990), Hamm and Symonds (2006), Henard and Szymanski (2001), Hilletofth (2009), Holger (2002), Iansiti (1995), Jain (2001), Karlsson and Åhlström (1996), Kess et al. (2010), Kotler et al. (2009), Kärkkäinen et al. (2001), Lummus and Vokurka (1999), Schmidt et al. (2009), Park et al., 2010, Swink et al. (1996), Van Kleef et al. (2005), and Wheelwright and Clark (1992).

Common process characteristics affecting the success of a new product are a strategic and holistic process view, as well as a structured approach to NPD. Further, the processes require support from information technology as well as involvement from senior management (e.g., Barczak et al., 2009; Cheng and Shiu, 2008; Droge et al., 2008; Gerwin and Barrowman, 2002; Hamm and Symonds, 2006; Henard and Szymanski, 2001; Schmidt et al., 2009). The company needs to understand its consumers, and based on their requirements structure internal and external processes so that the overreaching goals can be achieved.

3. The case study

The case company is a Swedish wholesaler from the furniture industry. Their headquarters, and central distribution centre are located in Sweden. The furniture is manufactured at independent manufacturers in China, who themselves are responsible for the materials sourcing. However, the case company collaborates with their manufacturers to ensure reliable supply. To overcome issues inherent with geographical and cultural distances, Alpha collaborates with a supporting team in China. Products and items are transported in full containers with ships from China, to the port of Gothenburg, and then delivered to Alpha's distribution center, or directly to key account customers (about one percent of volume).

Products and items may arrive in three different configurations: as knockdown products, items ready for assembly, or as complete products. The products are delivered to a customer (retailer) whenever a consumer places an order in a store. When the retailer receives the product, consumers will either be notified that they can collect the product, or get the product delivered to their door. Retailers experience an explicit consumer need for fast delivery after placing a purchase order. A few independent stores have decided to pick up the products at Alpha's warehouse instead of getting the goods delivered. This is not a problem, as Alpha's business model is flexible and invites to collaboration. Retailers invest in show room furniture, and it is important that the choice of display furniture is thoroughly considered. Many consumers are price sensitive, and distributors therefore focus on low cost production. However, there is demand for furniture in all price ranges. Alpha focuses on consumers in a premium segment. Retailers perceive Alpha to be at level three on a premium scale, where five is the highest, four is the highest level commonly available furniture in Sweden, two is IKEA and non-branded furniture available in most furniture stores, and level one is low quality furniture sold in stores that only focus on low price. This scale does not represent the actual quality of the furniture, only the perceived premium of the furniture.

To attract and retain consumers, a strong brand name is perceived to be important. The brand in the furniture industry is usually connected with the retailer. Consumers perceive that they buy a Mio sofa, an Europamöbler table, or a Svenska hem bed (three Swedish furniture retail chains). However, the consumers are not that aware of the manufacturer of the furniture, and all of three retailers mentioned above source furniture from common distributors. In this sense, the furniture industry differs greatly from, for example, the apparel industry, the computer industry, and the home electronics industry.

The product life cycle in the furniture industry is not related to the innovativeness of the product. There are products, colors, and materials that go in and out of fashion. However, these are the same for all price segments. High-end furniture may have a short life cycle during which it is modern, but some of the most modern and most fashionable products available on the market have remained unchanged for more than thirty years. A low cost product may have a lifecycle of several years, but it may also only live as long as it takes to sell one shipment.

3.1 Methodology

This research aims to explore the linkages between NPD and SCM, as well as how these concepts should be coordinated. The issue is examined through a literature review,

combined with findings from an embedded single-case study. The chosen approach to this research is best defined as explorative (Yin, 2009). Moreover, the case study approach was considered appropriate since the research tries to analyze contemporary events, in a complex setting in which the researcher has no control over the events (Yin, 2009). The research is mainly inductive (Smith, 1998), since it tries to create explanations and descriptions based on observations. The case company, called Alpha to retain its anonymity, is a small Swedish furniture company, focusing on NPD and the distribution of furniture to their consumer markets, of which Sweden, Norway, and Finland are the most important. In 2004 the case company decided to change business model from mass production and competing on low price, to developing products that provide superior consumer perceived value. The company was chosen based on the industry in which it is operating, and its efforts towards becoming consumer driven.

Since most phenomena cannot be explained in isolation (Flick, 2009), case studies may include qualitative data, quantitative data, or both (Eisenhardt, 1989; Yin, 2009). This allows the researcher to enhance understanding by examining the studied object from several perspectives. Qualitative data has been collected during a period of more than one year, starting the summer of 2009, with 60-90 minutes in-depth interviews with key informants representing senior and middle management. The interviews were then followed up with brief interviews and meetings with every employee at the company, except for warehouse personnel, visits to 15 retailers, and an activity day to which the most important customers were invited. Moreover, qualitative data was collected during a visit to manufacturers and the company's service team in China. Additionally, secondary data has been retrieved from internal and public documents. Business performance data is collected from 96 annual reports from the case company and 9 of its competitors. Due to corporate reconstructions, reports from 1999 to 2001 were excluded, leaving 80 reports, spanning from 2002 to 2009, in the comparison. The year 2002 is not represented in the graph, since sales growth and inventory levels rely on information from the current, and the previous year. Earlier years were excluded to present data from the time period during which the case company decided to change business direction.

Construct validity has been ensured by using multiple sources of evidence, gathering several pieces of evidence that build a chain of evidence, and allowing key informants to review reports, transcripts and findings. Discussing rival explanations for the findings with research colleagues, as well as personnel at the case company creates internal validity. A theoretical foundation guarantees the external validity. The case study protocol and a database of all gathered data ensure the reliability of the study (Yin, 2009). Moreover, triangulation of data, methods and theory (Flick, 2009), has contributed to the rigor, depth, and breadth of the results, which may be compared with validation (Yin, 2009), while enhancing the investigators' ability to achieve a more complete understanding of the studied phenomenon (Scandura and Williams, 2000). Since the case company has been chosen due to its unique characteristics, and the findings are based on contemporary events, the findings are foremost generalizable to theoretical propositions (Yin, 2009).

3.2 Findings

The case company has adopted a strategy where it attempts to offer added value by gaining insight into consumers' explicit and implicit needs. In essence, it is in a transformation from

cost and volume focus to provide superior value by becoming innovative and consumer-oriented. The case company has defined NPD as the major business process, with SCM as a support function, trying to develop innovative products, with added perceived consumer value, at a premium price. The NPD process and how it is related to SCM is further described below, along with business performance records of the case company.

3.2.1 New product development

Alpha’s process for developing consumer-focused products is described within the NPD approach. It is adopted for all target markets, with the purpose of managing the product lifecycle, by incorporating all areas of creating and selling products. The CEO has the overall responsibility for NPD, while the managers of NPD, purchasing/logistics and marketing are responsible for assigned areas. As of today, the areas are not clearly defined. The three main phases of Alpha’s NPD process are market intelligence, product creation and commercial launch (Figure 1).

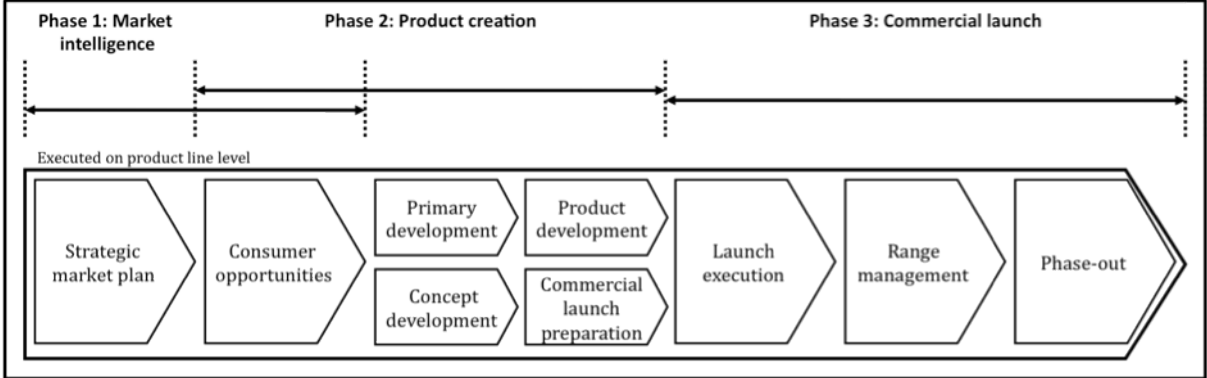


Figure 1 The new product development process

The objective with the market intelligence phase is to ensure a clear identification and prioritization of opportunity areas and to express these in a strategic market plan (SMP). Consumers are divided into nine segments based upon psychographics and design styles. The resulting matrix is called the product platform (Figure 2). Furniture collections are placed in their segmentation square, and are color-coded based on their performance and life cycle. The product platform has a close relationship to the SMP and helps the case company during its market intelligence phase.

During consumer opportunities, the first stage in the case company’s NPD process, Alpha tries to collect consumer insight. That is, forming a profound understanding of consumers, going beyond what consumers know about themselves and are able to express. Consumer insight, segmentation and product development is aimed at increasing the consumer perceived value. The quality of the products is thought to be the quotient of the consumer perceived value and the consumer expected value.

Consumer insight is gathered by visiting potential and actual consumers in everyday situations and photo-documenting their homes. Through this process, the case company has been able to identify business opportunities they previously were unaware of. External personnel, under guidance of the case company, perform the study of consumers’ homes. Over the course of six years since the NPD approach was adopted, Alpha has managed one

NPD project per year. As a result the number of consumer available products has more than tripled as a result of new identified consumer opportunities.

Product Platform		Design Styles		
		Style A	Style B	Style C
Consumer Groups	Group A			
	Group B			
	Group C			

Figure 2 The product platform

New Product Development			
NPD Stage	Description	Illustration	Alternative
Consumer Opportunities	Explore chosen room/ furniture type to find consumer opportunities		By chance, or observation get an idea for a product
	Gather consumer insights regarding consumer opportunities and present them to designers		
	Residual ideas	!!!!!!!!!!	
Primary Development	Design furniture based upon consumer opportunities, targeted square in the product platform in accordance to restrictions in the material matrix		
	Analyze presented ideas and prioritize future product development		
	Residual ideas	o o o o o o	
	Winning product concepts, prototype creation	o o	
	Redo previous steps, continue to product development, put down		

Figure 3 The consumer opportunities identification process

The object with the product creation phase is to define and develop consumer relevant and innovative products, addressing well-understood consumer needs. The first step, also discussed above, is consumer opportunities. Based on an assessment of the product platform, and the SMP, a room or furniture type is targeted. During primary development a number of squares in the product platform are targeted. The decisions of the designers are restricted to their targeted square, but also to a list of pre-chosen materials, called the

materials matrix. The manager of NPD is responsible for the materials matrix. Choice of materials is limited to secure sourcing, but also to ensure coherence and flexibility between different furniture collections.

Parallel to the NPD process, employees might come up with ideas that have not gone through the process mentioned above. For example, one of the company's bestselling furniture collections includes products co-developed between the manager of purchasing/logistics and the manufacturer. Here, consumer opportunities are identified outside the outlined process. However, in primary development furniture is still designed in accordance with the materials matrix and the product platform. The described process is summarized in the company's consumer opportunity identification process (Figure 3). The founder of the company points out that the process generates a lot of residual ideas that may be used in the future, depending on internal capabilities and prioritization.

To ensure successful NPD, a large amount of time is invested during the early NPD stages. However, the external personnel (mainly students) invest much of the time while internal personnel guide the project. Hence, the economic investment is kept at a minimum during the opportunity identification process. New products have been well received among the retailers. "You are really good at making new furniture. They have great features, and offer a lot of flexibility to the end consumer", one storeowner told to the CEO at a meeting.

3.2.2 Coordination of NPD with SCM

The high focus on NPD, in combination with decreased sales, has had a negative effect on supply chain performance. However, due to the complex market setting it is hard to determine to what extent NPD has caused effect on business performance. The CEO is aware of the bad fit between the business model and processes, and acknowledges that future product launches must be considered carefully. Even if a product has all the potential to be successful in the market, the supply chain capabilities might not support the introduction of more products. This need to balance value creation and value delivery is confirmed by the manager of purchasing/logistics, as he struggles with capital tied up in inventory, and increasing complexity due to a high number of products and items relative to turnover. A modular design is used to reduce the number of inbound products and items in relation to the amount of consumer available products. Managers within the marketing-side believe that high emphasis on demand creation will result in higher volumes, and result in scale benefits in the supply chain. As of today, it is a shared belief by the managers that the company needs to focus on increasing sales.

Modular design, and a new forecasting system have been implemented to support the new business model. However, the sourcing structure has remained virtually unchanged. Alpha used to source products from Malaysia and China, but is now relying solely on production in China. The choice of manufacturing country has led to several implications. The lead-time from placed order to delivery at the case company is about 16 weeks, which has put requirements on the accuracy of the forecasting. Manufacturers in China have been able to negotiate contracts with companies in several companies. For two main reasons the US market has been preferred over the Scandinavian and northern European markets at several manufacturers. Firstly, US companies have been able to place larger orders which makes it easier for the factories to reduce set-up times, and it has also led to easier production planning. Secondly, the US market has a demand for furniture with a distressed finish, while

the Scandinavian market requests a pristine (often white) finish. Hence, Scandinavian furniture requires a cleaner manufacturing environment, which is hard to achieve in factories that are adopted for a distressed finish. Furthermore, the manufacturing industries lost labor capacity after the Chinese New Year (Gregorian calendar: February 14th, 2010), and, in the fall of 2010, when floods affected factories.

The developed products are highly innovative and offer solutions for problems that consumers have not been able to articulate. Alpha's customers, the retailers, have the responsibility for consumer sales. In order to communicate the benefits of the case company's products, the retailers' role is of utmost importance. Hence, coordinating NPD with this part of the supply chain is vital. A storeowner who just sold the most expensive dining table offered by Alpha without being able to show it to the consumer was asked by the CEO of Alpha how she was able to do it. She casually replied: "I like your furniture." In the hands of that retailer, the value of the innovative NPD process is conveyed to the consumer. However, the main focus at Alpha has not been to make the retailers love and understand their furniture. The sales representatives at the case company are assessed on their ability to get display items sold to the stores. In essence, the case company is a testament to that NPD and SCM need to be coordinated on a macro level. NPD activities have a huge impact on supply chain performance, and collaboration in the supply chain seems to determine how well the benefits of innovative products are conveyed to the consumer.

3.2.3 Business performance

There is no follow up in the case company with regard to the success of newly developed products or the development costs. The cost for the management of NPD is, together with the cost for warehouse employees and manager for customer service, distributed across all items as an overhead cost. According to the logistics/purchasing manager, the recent years have been a period of trial and error, where the company just recently has been able to focus on the right newly developed products. During the trial and error period the number of items has more than tripled, which has led to a lead-time increase of about 50 percent in both manufacturing and delivery. Another consequence is the increased complexity of consolidating goods. Furthermore, Alpha and many of its retailers have experienced loss in sales.

The performance of Alpha's competitors was used to calculate a 95% prediction interval for the change in sales, inventory, and inventory turnover between 2004 and 2009, the period during which the case company changed their business model. For all three intervals, Alpha's values are within the prediction interval, implying that its performance is not significantly different from that of their competitors.

The performance of the ten biggest Swedish furniture distributors (Alpha included and IKEA excluded) is aggregated to a fictive company named "Total", representing the industry as a whole. IKEA was excluded since their business model differs from the other represented companies. Alpha and the included competitors do not have any stores of their own, but have to rely on external retail channels. Alpha's and Total's performance is illustrated in Figure 4. As indicated, Alpha's sales have an index of 154, compared to Total's index of 110. Total has decreased its inventory levels the last two years, while Alpha only managed to decrease inventory levels over the last year. Inventory levels have increased, especially from

2005 on. Alpha's inventory index for 2009 is 201, compared to 152 for total. Turnover in inventory has decreased for both Alpha and Total, with the index for 2009 being 80, and 56 respectively. The case company's turnover in inventory has decreased, while sales have dropped. Apart from this, the number of stock keeping units has increased. The negative numbers for Total supports the notion that the business environment has been tough the last years.

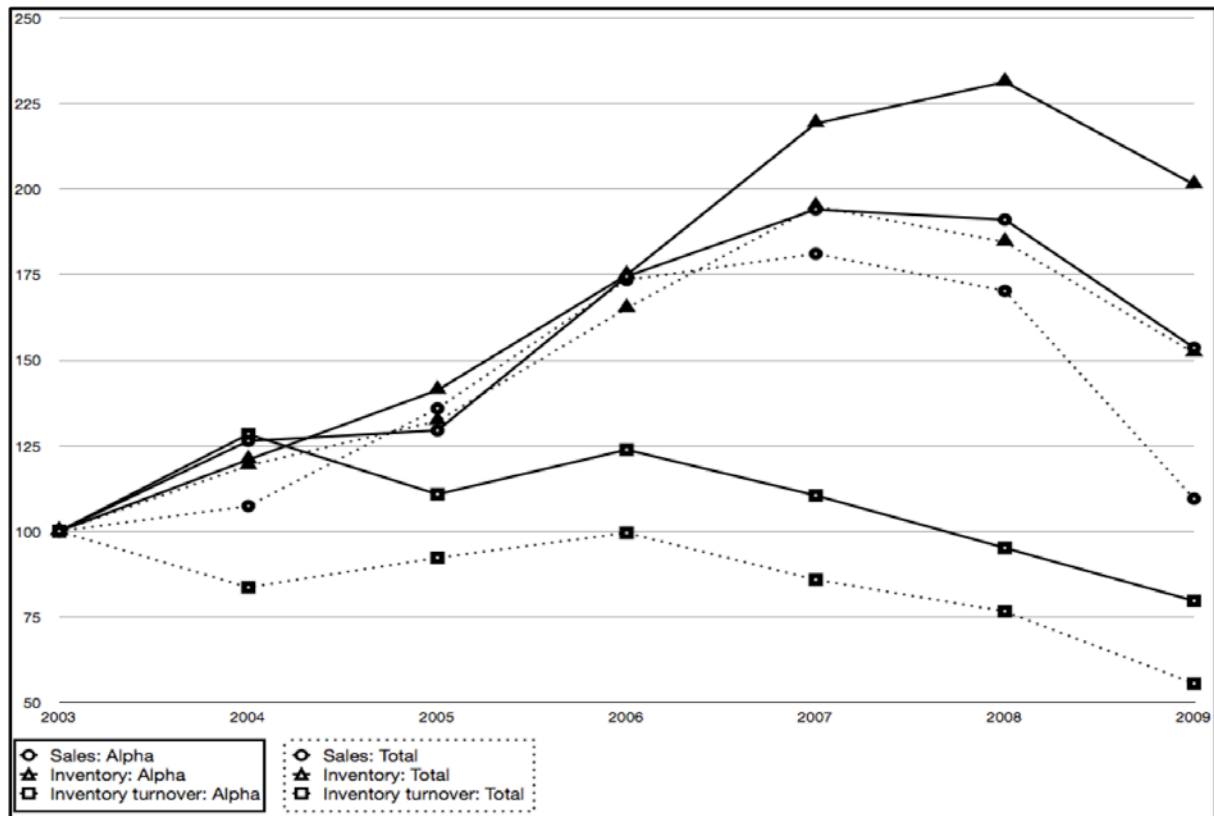


Figure 4 Performance evaluation of the case company based on index 100 year 2003.

The empirical data findings make it evident that the sales have dropped for companies in Alpha's business environment. Compared with sales growth, inventory levels have increased the last three years, which have led to a reduced inventory turnover. Despite the recent drop in turnover, Alpha's sales are still higher than before they changed direction in their business model, and they seem to face big challenges in managing inventory and the product range, while at the same time stimulating demand.

3.3 Analysis

One success factor of NPD shown in this research, in accordance with the literature (e.g., Barczak et al., 2009; Cheng and Shiu, 2008; Cooper et al., 2004; Droge et al., 2008; Kotler et al., 2009; Kärkkäinen et al., 2001; Schmidt et al., 2009), is that successful NPD requires a holistic view from strategy to commercialization. This implies that several functions need to be incorporated in the NPD process, for example, marketing and sales, product development, R&D, sourcing, manufacturing, and distribution. In this case, the connection to SCM is that different supply chain competencies (sourcing, manufacturing, and distribution) have to be involved in the NPD process to provide feedback from a logistics point of view during the different development stages (Table 2). Another reason to include a supply chain

representative in the NPD process is that it provides an opportunity to address NPD and supply chain design (SCD) in parallel.

Another success factor of NPD shown in this research, as well as in the literature (e.g., Barczak et al., 2009; Cheng and Shiu, 2008; Cooper et al., 2004; Droge et al., 2008; Hamm and Symonds, 2006; Jain, 2001; Kotler et al., 2009; Van Kleef et al., 2005; Schmidt et al., 2009), is that NPD should be driven by consumer needs and requirements identified through market intelligence (market-oriented), rather than by technology improvements alone. This requires a profound knowledge of consumers and their requirements. In this case, the connection to SCM is that the provided supply chain solutions also need to be developed based on consumer needs and requirements. This implies that companies, when gathering information concerning the need for new products, also should collect information regarding consumer service needs in order to develop the most appropriate supply chain solutions.

Table 2 Important issues in NPD and their influence on SCM

Requirement	Connection to SCM
A holistic view from strategy to commercialization.	Different supply chain competences have to be involved in the NPD process to provide feedback from a logistics point of view. This also creates an opportunity to address NPD and SCD in parallel and as early as possible.
Development of products based on needs identified through market intelligence (customer-oriented).	The provided supply chain solutions also need to be developed based on customer demand. This implies that companies when gathering information concerning needs of new products, also should collect information regarding service needs in order to develop the most appropriate supply chain solutions.
Development of products based on a segmentation model	Customers' requirements may also differ when it comes to lead-times and service levels, as well as preferred supply chain solution, implying that several solutions are required to become successful in the market. All the operations should be directed based on the same overall segmentation model.
Development of new and innovative products in accordance with customer preferences.	Unwise to restrict innovation to products, other areas should also be included, such as supply chain solutions. These issues need to be considered in the NPD process through involvement of supply chain representatives and by establishing information exchange between NPD and SCM. The objective should be to address these issues in parallel.
Developing products rapidly and moving them quickly and efficiently to the market.	Time-to-market is not solely determined in the NPD process but also in, e.g., sourcing, manufacturing, and distribution. This implies that supply chain representatives should be involved early in the NPD process to shorten time-to-market.
Incorporating all the activities supporting the commercialization (integrative NPD approach).	SCM and NPD need to be coordinated to successfully introduce products on the market, to ensure that the product assortment is updated according to product life cycles, and to ensure that obsolete products are properly out-phased.

One more success factor of NPD identified in this research is that NPD needs to be based on a segmentation model, including a set of market segments, since the preferences of different consumers' may vary greatly. This is also put forward in the literature (e.g., Cooper et al., 2004; Hilletofth et al., 2010; Kotler et al., 2009) and means that products are developed to meet needs that have been identified within a specific market segment. In this case, the connection to SCM is that the consumers' requirements also may differ when it comes to lead-times and service levels, as well as to preferred supply chain solutions (e.g.,

procurement and distribution alternatives); implying that several solutions are required to become successful in the market. Moreover, it can be argued that all operations should be directed based on the same segmentation model in order to create a truly consumer-oriented organization. This implies that the same overall segmentation model should be applied in NPD and SCM; and this evidently requires coordination between these management directions.

A further success factor of NPD shown in this research, also reflected in the literature (e.g., Barczak et al., 2009; Cheng and Shiu, 2008; Droge et al., 2008; Hamm and Symonds, 2006; Jain, 2001; Kotler et al., 2009), is that it is important to continuously develop new (or modify old) products in accordance with consumer preferences. It is also important that the products are innovative and thus attractive on the market. In this case, the connection to SCM is that it is unwise to restrict innovation solely to products and their attributes, since companies offer more than a product; they offer a value package, including not only the physical product, but also related services (e.g. delivery and assembly). Other areas should also be included, such as supply chain solutions. These issues need to be considered in the NPD process through involvement of supply chain representatives and by establishing an information exchange between NPD and SCM, the objective should be to address these issues in parallel.

An additional success factor of NPD highlighted in this research, as well as in the literature (e.g., Carillo and Franza, 2006; Chen et al., 2005; Hamm and Symonds, 2006; Jain, 2001; Kotler et al., 2009; Van Hoek and Chapman, 2007), is that it is important to rapidly develop products and to move them efficiently to the market. Shortening product life cycles and more rapid product obsolescence mean that the right products must be developed and successfully launched in ever shorter time frames. In this case, the connection to SCM is that TTM is not solely determined in the NPD process but also in, for example, the ramp-up of sourcing, manufacturing, and distribution (SCM). This means that supply chain representatives should be involved early in the NPD process to shorten TTM.

A final success factor of NPD identified in this research is that NPD not only enables the efficient flow of new products, but also assists the ramp-up of various supply chain activities, such as sourcing, manufacturing, distribution, as well as other related activities supporting the commercialization of the product (marketing and sales). These issues need to be addressed in parallel and this requires an integrative NPD process. This is also put forward in the literature (e.g., Carillo and Franza, 2006; Kotler et al., 2009; Sharifi et al., 2008; Van Hoek and Chapman, 2007). In this case, the connection to SCM is that it needs to be coordinated with NPD in order to successfully introduce products on the market, to ensure that the product assortment is updated according to product life cycles, and to ensure that obsolete products are properly phased out.

4. Concluding discussion

In this research, several linkages between NPD and SCM have been identified. These linkages motivate the use of an integrative NPD process where the design functions are aligned with other main functions in the company. In essence, this can be achieved by involving members from other main functions within the company in the NPD process (Portioli-Staudacher et al., 2003; Sharifi et al., 2006; Van Hoek and Chapman, 2006). These representatives should

be involved as early as possible and provide feedback from their function's perspective during the different development stages. The idea of an integrative NPD process is not new from a theoretical point of view. This topic has been addressed in concurrent design before and proposed concepts such as "design for manufacturing" and "design for supply chain" are quite often used to imply that the NPD functions are aligned and integrated with other main functions within the company (Appelqvist et al., 2004; Ellram et al., 2007; Perks et al., 2005; Sharifi et al., 2006; Sharifi and Pawar, 2002).

Evidently, the NPD process is supposed to be cross-functional, but usually only marketing, product development, and R&D are involved in this process. Thus, it can be argued that the NPD process to a larger extent needs to incorporate the main supply functions and other sales-related functions supporting the commercialization of the product. NPD not only enables the efficient flow of new products, but also assists to support ramp-up of various supply chain activities and need to take into account the impact on the performance and success of the supply chain when developing new products. Consequently, the NPD process needs to be coordinated with SCM in general and the SCD process in particular. The goal should be to create a consumer-oriented business by organizing the firm around understanding how consumer-desired products (e.g., innovative, customized, and affordable) are developed efficiently (NPD), how products are sourced, manufactured, and delivered to consumer efficiently (SCM), and how these management directions can be coordinated. It is important to note that firms not only need to work with these domains concurrently, but also coordinate them with one another on a macro level in a systematic way.

This consumer-oriented business approach is particularly beneficial in markets where short product life cycles is the norm and where delays in bringing new products to the market can have detrimental effects on profitability. To stay competitive in such markets, companies must produce consumer-desired products and bring them quickly and effectively to the market. This market environment is true for many companies in the furniture industry since it, like the apparel industry, is fashion driven. Firms that face this environment may encounter problems due to a high emphasis on either the value creation processes on the demand-side of the company (NPD) or on the value delivery processes on the supply-side of the company (SCM). Thus, the NPD activities need to be coordinated with the SCM activities, or the results may be devastating.

Our case company has started to implement this consumer-oriented business approach by developing unique and value adding products and bringing them quickly and effectively to the market. This helps them to distinguish themselves among consumers, as well as to avoid price competition from competitors focusing on cost and volume, such as IKEA. When it comes to a specific item group (e.g., kitchen table), IKEA has a quite narrow assortment and focuses on offering the lowest possible price. Our small case company cannot compete on price and instead focuses on the consumer, by trying to develop desired products. Its assortment offers value differentiation from IKEA, owing to customization options. Still, it is important to note that IKEA has more item groups than our case company and in that way has a significantly broader assortment. Moreover, IKEA has a different degree of control in their supply chain, since they own their stores. They do not have to engage in negotiation with retailers, and may focus on the strategic, tactical and operational alignment of distributors. The business model implemented by our case company is similar to the one

fruitfully applied by Apple. It also focuses on developing unique and value-adding products and bringing them quickly and efficiently to the market, and has a similar organization of the supply chain functions. One point where Alpha and Apple differ is in the product range. Alpha has tripled their product range the last three years. Steve Jobs return to Apple in 1997 was the start of Apples success. One of the first actions made by Jobs was to narrow the business scope. For example, eliminating 70% of new projects, and decreasing the number of product lines from 15 to 3 (Thomke and Feinberg, 2009).

This research has shown the practical implications of a consumer-oriented business model at a small Swedish furniture distributor. A strong focus on the demand-side (NPD) has induced high demands on the supply-side of the company. This emphasizes the importance of viewing the demand and supply processes as complementary, and stresses the need for coordination between them. Since there is strong support for this finding in the literature (e.g. Esper et al., 2001; Hilletoft et al., 2009; Jüttner et al., 2007), the finding is most likely generalizable to companies of different sizes, in different countries, and in different business environments. This research also puts forth the social aspects of globalization and the inherent consequences of increased geographical and cultural distances. In our case company, NPD does not employ one full-time employee; warehousing employs two people, while the manufacturing located in China employees a large amount of manufacturing personnel. In a market where consumer demand is increasing, so do the requirements on the demand-supply chain. By offering premium products, where the main order winner is not price, there may be financial opportunities to move production, or assembly, closer to the consumer market, resulting in increased domestic employment.

An interesting aspect for further research is to continue the investigation of coordination between NPD and SCM in firms acting in different markets and/or with other objectives. In addition, there are other processes within our company, as well as aspects that need to be investigated to provide an inclusive description of the consumer-oriented business model, for example, the effects on sourcing, distribution, and information systems. In essence, the research needs to be broadened with new case companies, and deepened by investigating more parts within the respective case companies, in order to contribute to the overall understanding of the consumer-oriented business approach, its positive and its negative effects. Another interesting aspect for further research is to investigate the opportunity to move manufacturing closer to the consumer market if the increased cost is absorbed by higher contribution margins. Short distances between production and consumption will decrease transportation lead-times, and will probably lead to higher flexibility and better supply chain responsiveness. However, research is needed to understand if a consumer-oriented business approach, offering superior consumer value, may justify manufacturing in high cost countries.

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