New Product Development in a Manufacturing Company – A Challenge for Supply Chain Management

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ABSTRACT

The last decades a new type of business environments has evolved characterized by rapid and volatile demand changes, short product life cycles, and high levels of customized products. The competitiveness of a business in these environments is mostly determined by its responsiveness. This is characterized by the ability to quickly scale up or down the production volume, the presence of an innovative and fast product development, and the quick incorporation of customer requirements into the product development. This paper employs a descriptive single case study approach to illustrate how product development is structured and executed in an international manufacturing company, seeking to realize an innovative, predictable, and efficient product development. The objective is to increase the understanding of how product development and product life-cycles are connected to Supply Chain Management (SCM). Case study findings reveal that the case company after implementing a strategic and structured Product Creation Process (PCP) has improved the efficiency and effectiveness of product development. Findings also reveal that the case company has not yet developed any linkages between product development and SCM. Still, the case company has become aware of this issue due to problems associated with the lack of integration between product development and SCM.

1. INTRODUCTION

Supply Chain Management (SCM) can be defined as a set of approaches utilized to efficiently integrate and coordinate the materials, information and financial flows across the Supply Chain (SC), so that merchandise is supplied, produced and distributed at the right quantities, to the right locations, and at the right time, in the most cost-efficient way, while satisfying customer requirements [1]. One business process that truly affects SCM is the product development process. Without new products, market acceptance and value added packages, an efficient SC is useless, supplying, producing and distributing the wrong products efficiently [2]. However, SCM also affects product development since product competitiveness is not solely restricted to product attributes, but also concerns customer service, and these issues needs to be addressed in parallel [3]. This is particularly the case for consumer markets, where it is important to evaluate and provide accurate procurement and logistics alternatives.

In recent years a new type of business environments – characterized by rapid and volatile demand changes, short product life cycles, and a high degree of customized products – has evolved [4]. In this environment innovative and rapid product development is extremely important, implying that product development must focus on customer needs rather than on technology improvements alone. This means that successful product development requires a deep understanding of customers and their needs. Many companies wish or claim to be customer oriented, however, customer-driven product development is a demanding and difficult task. The voice of the customer must be taken into account in all the phases of product development, both in definition and design phases.

Shortening of product life cycles, more rapid product obsolescence, and the increasing intensity of global competition have driven firms to strive for a rapid introduction of new products [5]. The ability to reduce cycle time in product development is increasingly viewed as a key to innovation success and profitability [6]. First-to-market products may command higher initial prices and gain a dominant market share, as well as customer loyalty [7]. Compressing the new product development process lead times may also result in significant cost reductions. However, shorter product life cycles also implies that product development must be integrated with SCM in order to

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successfully introduce products on the market and to ensure that the product assortment is updated according to product life cycles and that obsolete products are properly out-phased [8]. This implies that an effective implementation of the product development process not only enables management to coordinate the flow of new products efficiently, but also to assist in the ramp-up of manufacturing, logistics, marketing and other related activities, that support the commercialization of the product. For this reason, companies need to address all these issues in parallel to be successful.

In this research a descriptive single case study approach is used to illustrate how product development is structured and executed in an international manufacturing company that seeks to realize innovative, predictable, and efficient product development. The aim of our research is to form an understanding of how product development and product life-cycles are connected to SCM. Instead of using an SCM perspective, we outline how the product development is structured and executed in the case company. Our research is mostly descriptive, and aims to shed more light on how SCM and a formalized product development can be connected. The research question is: “What effect will new requirements of a product development process have on SCM?’’ The primary research approach consists of an embedded single case study, which was considered appropriate in order to gather in-depth data. The case company is Husqvarna, a Swedish manufacturer operating on an international basis in the outdoor power products industry. The remaining of this paper is structured as follows: First we present a literature review of the product development process in Section 2. Thereafter, Section 3 presents and discusses research approach and data collection. Section 4 presents case study findings. In the final Section 5 research is discussed and concluded, and further research ventures are proposed.

2. LITERATURE REVIEW

SCM is recognized as the integration of key business processes across the SC. One of these important business processes is product development and commercialization. The Product Development and Commercialization (PDC) process provides the structure for developing and bringing new products to the market, at best jointly with customers and suppliers [8]. Effective implementation of the process not only enables management to coordinate the flow of new products efficiently across the SC, but also supports the ramp-up of manufacturing, logistics, marketing and other activities related to the commercialization of the product.

Developing products rapidly and moving them into the marketplace efficiently is important for long-term corporate success [9]. In many markets, 40 percent or more of revenues come from products introduced in the prior year [10]. The ability to reduce the time-to-market is key to innovation success and profitability [7] as well as being the most critical objective of the process [11]. As product life cycles shorten, the right products must be developed and successfully launched in ever shorter time frames, so that competitiveness [12] and marketplace differentiation may be achieved. One branch of product development research consists of analytic models to determine the trade-offs between overall product quality and time-to-market [see e.g. 13]. Another branch has focused on identifying specific mechanisms, whereby a firm can improve its product development process [see e.g. 14].

While a considerable body of research has focused on the time-to-market and process improvement problems in isolation, consideration of both design and production (or logistics) decisions to support bringing new products to market has remained relatively unexplored [15]. In their review of product development literature, Krishnan and Ulrich [16] comment that the literature addressing production ramp-up and product-design decision-making is relatively sparse, though notable exceptions exist [see e.g. 17].

Numerous researchers have proposed product development models with 5 to 10 phases for product development [see e.g. 18]. In their review of the product development literature, Karkkainen et al. [19] argue that the product development process consists of three interconnected phases: (1) strategic planning, (2) customer need assessment, and (3) product development. The objective with strategic planning is to ensure clear identification and prioritization of different product development areas by setting specific goals for product development. The goals define the starting point for customer need assessment and product development. Strategic planning builds on current business strategies (e.g. product innovation strategy and brand and design strategy), and serves to clarify business goals before initiating the customer need assessment and the product development phases to avoid the danger of performing the wrong activities. All the people involved in the development activities must understand the goals clearly and keep them in mind during the whole development process. The objective of customer need assessment is to clarify customers’ needs as well as the competitive situation for the company. Customer-driven product development requires proper customer need assessment, which is a systematic activity of gathering and clarifying customer needs, determining product characteristics based on the clarified needs and ensuring that all important needs will be fulfilled. Careful, systematic need assessment helps to focus development efforts and to
reduce the need for future design changes. Many commonly used need assessment methods have originated from statistics and market research. Urban and Hauser [20] describe how different market research methods can be utilized in product development. In spite of the importance of need assessment for product development, need assessment is often implemented in an unstructured and unorganized way in companies [19]. This is partly a consequence of a lack of proper tools and information about how to use them. According to Holt et al. [21] methods for need assessment are poorly developed compared to more technical tools for product design.

3. RESEARCH METHODOLOGY

In this paper it was considered that an inductive approach was the most appropriate research strategy since the aim was to enhance current knowledge of how SCM and a formalized new product development could be connected by investigating one international manufacturing company in a qualitative manner. Moreover, due to the context-bound nature of the studied phenomenon, case studies would be an appropriate method. Thus, this paper employs a descriptive embedded single case study [22]. The case company (Husqvarna) is a Swedish manufacturer operating on an international basis in the outdoor power products industry.

One advantage with case studies is the possibility to combine several data collection techniques; in this research empirical data was collected from various sources to enhance understanding by examining the research object from several perspectives. Firstly, this study is based on data gained from in-depth interview with the chief of administration in the product development department; the interview was conducted in 2007. Digital recording in combination with note taking was the main interview method, and the length of interview was 120 minutes. In order to find relevant information the interview was prepared carefully. Furthermore, interviewee was able to read the transcribed interview text afterwards to avoid misunderstandings. Moreover, this study is based on a number of internal (i.e. annual reports and technical reports) and external documents (i.e. industry reports). These were included to provide information to both the industry and the case company’s background.

The data collection has been well documented and digitally recorded, which increases the reliability of the case study. However, it should be noted that all case studies are unique and the companies are continuously changing, meaning that the conditions can never be identical. Two tactics have been applied to increase the validity of this study. Firstly, multiple sources of evidence have been used, and secondly, the draft case study reports have been reviewed by the respondents. Different sources have been used to answer the same questions and therefore triangulation can be said to have been used. The use of triangulation has contributed to improving the rigor, depth, and breadth of the results, which can be compared to validation [22]. However, it also enhances the investigator’s ability to achieve a more complete understanding of the studied phenomenon. Nevertheless, in retrospect, the overall reliability and validity of the study could have been further improved by increasing the number of informants and extending the period of data gathering to encompass multi-points in time rather than providing a retrospective snapshot.

4. CASE STUDY: HUSQVARNA

Husqvarna is the global leader in outdoor power products for forestry and lawn and garden maintenance, as well as cutting equipment and diamond tools for the construction and stone industries. The company sells products to consumers and professionals in more than 100 countries. The largest markets are in North America (54 %) and Europe (40 %), only smaller quantizes are sold in the rest of the world, with the Asian market becoming increasingly important due to the development in China. In 2007, Husqvarna had sales of SEK 33 billion and approximately 16,000 employees.

The case company’s operation is currently organized in two business areas: (1) Consumer products and (2) Professional products. The consumer products share of total sales (67 % of total sales) has increased in recent years; however, the case company makes more profit in the professional sector (33 % of total sales). The products are manufactured around the world and sold under several brands; however, the major share of products is sold under the Husqvarna brand (40%). Some brands are used in both the professional and consumer sector while others are solely professional or consumer brands. The case company’s manufacturing strategy is to manufacture as close as possible to major final markets. Accordingly, most of the products are currently manufactured in North America and Europe. However, opportunities to manufacture components in low-cost countries in Asia and transport these to assembly plants near final markets are being considered. The major issues of this approach are the extensive transportation lead-times (5-6 weeks by sea, air is not a long-term option due to costs incurred) and the risk of a
decrease in product quality. Additionally, the current market in Asia is small (1-3%), making the location of factories there a less interesting option. The case company uses different distribution channels to a certain extent. For professional products it exclusive uses specialized retailers while it for consumer products primarily uses ordinary retailers.

On the consumer market the case company has noticed that it has become increasingly important to continuously develop new or modify old products in accordance with customer preferences. Consumers are more impatient than professional customers who prefer proven functionality and technology. Additionally, cost has become the major order winner while quality is a qualifier. This means that the SC operations need to be cost-efficient and provide high quality output. Moreover, it is very important to have a strong brand that signals high quality and that communicates the company’s values. In order to survive in this environment the case company believes that it needs to create a truly customer-oriented organization by focusing on cost-efficient and customer-oriented product development as well as efficient coordination of world-wide demand with manufacturing and supply. For this reason, the case company has developed a process for customer-focused product development entitled Product Creation Process (PCP), which is detailed in the next section.

4.1 PRODUCT CREATION PROCESS

The PCP is a holistic process for managing product development. It describes all areas of creating products, while keeping the customer needs in focus. The purpose of the process is to make sure that all the necessary information is collected at the right time to realize efficient and effective planning in the short and in the long-term. The process is executed on product category level and it is project oriented, meaning that that each product category is dealt with separately and that each time the process is initiated a new project is created. All the projects within a certain product category are managed by a business manager that is responsible for the progress of the projects. The PCP consists of four phases, which all contain steps, activities and check points that need to be dealt with during the product development work (Figure 1). The objective of the first phase (strategic market planning) is to ensure clear identification and prioritization of opportunity areas by establishing a strategic market plan for the product category. The plan is built on corporate prerequisites (e.g. product innovation strategy, brand and design strategy as well as global needs) along with industry analyses. Examples of questions that pertaining to this step are: on which areas should we focus our innovation work, which changes in consumer behaviour can create business opportunities, where are the growth markets, and what can we do that our competitors have not yet done?

![Figure 1: Product Creation Process](image)

The second phase consists of two parallel steps: Business opportunities and Primary development. During the business opportunity step an understanding of customer needs in the targeted product category is obtained through customer insight. To gather customer insights the case company uses several techniques such as observations, surveys and evaluations. However, observations are preferred, as observed behaviour is richer than described behaviour. Still, this kind of research is quite hard to employ since local product creation processes develops global products and the requirement can differ greatly between different regions or even between countries within a certain region. After that, the case company tries to identify means of developing products that satisfy the identified needs. Then it describes the needs and suggests a solution in a project proposal (PP). Each product category has a product council that decides whether proposed projects are accepted for product development or not. In primary development, technical solutions within the targeted product category are developed producing verified ideas or hardware solutions that can be applied to relevant projects in product development.

The objective of the third phase (product development) is to develop products based on an accepted project proposal. The phase consists of three steps, each including a number of stages (Figure 2). Each stage includes
several activities that need to be dealt with, and before the project is approved to advance to the next stage it must pass a check point.

The objective of the first step (project specification) is to create a specification of requirements based on the project proposal and later conduct several theoretical investigations concerning how the specification may be realized. In this step as much information as possible is collected to provide an efficient front-loading of the process. This strategy is defensible since the projects in this phase still are rather inexpensive. Following this, product specifications are verified with respect to the collected information and the theoretical investigations. This means that one project proposal can result in more than one product development project. The last stage in the project specification step is prototyping, which refers to the creation of a prototype of the verified product specification. The prototypes are very precise, and several tests are conducted on them. These tests are conducted by cross-functional teams consisting of persons from several departments such as procurement, production, service, laboratory, R&D and product development. Two of the areas that are highlighted in these tests are ease of assembly and ergonomics. Exhaustion and firmness tests are not conducted in this stage since each prototype approximately cost 0.5 million SEK to develop.

If the prototype is accepted the project enters the next step, project industrialization. The length of this step differs between product categories. In the industrialization step, the case company needs to invest in real machines and tools. These investments can be quite large and it is thus important to run the industrialization step as efficiently as possible, regarding both cost and time, in order to provide revenue as fast as possible. The first stage of the industrialization step is to manufacture a couple of test batches of the product. Between each test batch the manufactured products are evaluated in several ways to identify errors and possible improvements. For instance, the products are tested in a laboratory (emissions, vibrations, noise) and in relevant field studies. A chainsaw for the North American, South American, and Scandinavian market needs to be tested in all these environments. After a number of test batches has been manufactured and no more errors or possible improvements can be identified, the product is approved for the next stage. In the next and final stage of the industrialization step, a number of pilot batches are manufactured. In this stage the purpose is to make sure that the company’s and its suppliers processes are aligned and working efficiently.

After the case company has secured the processes, the project is approved for the final step, production. This means that the company now starts to produce and sell the product on the markets. In the beginning of this step the case company continuously evaluates the results to determine if changes or improvements are needed. During this evaluation period the company also evaluates whether the project was successful or not. Finally the project is closed and production continues.

The objective of the final phase (phase out) is to ensure that the product assortment is updated accordingly to products life cycles and that obsolete products are properly out-phased. Both these objectives rely on a consistent follow-up period.
4.2 ROLES AND RESPONSIBILITIES IN PRODUCT CREATION PROCESS

Essentially three departments are involved in the PCP: Marketing, Product development and R&D. The product development department consists of several product divisions. Depending on where in the PCP a project currently is the involvement of the different departments differ (Figure 3).

![Figure 3: Roles and responsibilities when executing Product Creation Process](image)

The marketing department primarily works with the strategic market plan; product development primary works with business opportunities as well as generation and portfolio planning; while R&D primary works with primary and product development. The marketing department is closest to the customers; however, the product development department also work with customers regarding product concept and different investigations.

4.3 RESULTS AND IMPROVEMENT AREAS

After implementing the PCP the case company has improved the efficiency and effectiveness of product development. Improved effectiveness means that it to a larger extent develops product that their customers demand, while improved efficiency means that it develops more products faster and at a lower cost than before. The intensity of products development has increased, leading to more active product development projects. On a yearly basis the case company manages around 6-7 larger projects, each resulting in 5-6 new products, along with approximately 25 smaller projects concerning minor improvements, face-lifts and cost reductions of existing products. Moreover, the development time has been reduced over all product categories. Currently a professional product takes approximately 3.5 years to develop while simple consumer products take one year to develop.

The PCP focus on products attributes and the objective is to develop products that the customers desire. Questions concerning how to sell and introduce products on the market as well as how to distribute them to customers are not considered (i.e. customer service). These topics are often considered afterwards, by other personnel in the organization. The case company is aware of the need to investigate this issue further and considers changing the process in the nearby future. This is because product competitiveness is not solely restricted to product attributes, but also as it concerns customer service; these issues needs to be addressed in parallel. This is particularly the case in the consumer segment, where it is important to evaluate and provide accurate procurement and logistics alternatives (e.g. perhaps it is necessary to provide both ordinary shops and e-shops, requiring different logistics capabilities). This issue also becomes increasingly important since the consumer segment is increasing in comparison to the professional segment. One example where the case company was affected by the issue highlighted above was when it developed the Automower (an automatic lawnmower). When this consumer product was developed and ready for production, the case company realized that it was quite different to existing consumer products, and therefore required other distribution channels. These channels were not developed since this issue not had been encountered before. This led to an initial use of inappropriate distribution channels. The major issue was that this consumer product was more complex than ordinary consumer products and required skilled sales personnel, which the current consumer distribution channels did not provide.

5. DISCUSSION AND CONCLUSIONS

The conventional approach to product design and development is to assign representatives from support functions to review and recommend changes as the process evolves. The more recent concept of concurrent design involves a multi-function design team, which is highly structured and with greater responsibility and authority. Concurrent design has, so far, mostly focused on internal collaboration. However, in today’s global competition,
New tools, such as Service Oriented Architecture (SOA) and Event Driven Architecture (EDA) enable alignment and integration on operational, tactical as well as strategic levels [30]. Processes to full-scale cooperation and collaboration based on Information and Communication Technology (ICT).

From an end-to-end perspective, this means that the design function is aligned and integrated with other main functions in the company and in the extended enterprise. Traditionally, most organizations have been functional in their structure with responsibility for each stage in the SC, including design, being separate from the other. Typically in these businesses, the new product development process is linear and sequential with a consequent lengthiness of time-to-market and time-to-volume. In today’s challenging markets, these ‘silo’ type structures are not capable of rapid response to fast-changing requirements. In the market places where short product lifecycles are the norm, delays in bringing products to the market can have detrimental consequences to sales and profit.

To sustain attractive in the future, businesses will need to produce innovative, high-quality, highly value-added products and services and bring them quickly and effectively to the market. Two major issues need to be addressed: (1) the need to develop innovative, value-adding products; and (2) the necessity of bringing them quickly to the market. This can be achieved by simultaneously working with customer-oriented product development (to create an effective and efficient product development) and SCM (to create an effective and efficient SCs); which is a subject addressed in the emerging Demand Chain Management (DCM) approach. It is important to note that companies, in order to be successful, not only need to work with these areas simultaneously, but also connect them to one another. For instance, SCM is affected by product development; without new products, market acceptance and value added packages, an efficient SC is useless, supplying the wrong products very efficiently. SCM also affects product development since product competitiveness is not solely determined by product attributes, but also by the included services in the total value offering. Companies offer more than just a product, they offer a value package and therefore it is important that product innovation is not restricted to product attributes; it should also be applied in other areas such as customer service. This means that companies, when gathering information regarding needs of new products or product features, should also collect information regarding service needs and should consider integrating manufacturing and logistics in order to identify the most appropriate SC strategy for each customer or group of customers. Additionally, product development needs to be integrated with SCM in order to successfully introduce products on the market and to ensure that the product assortment is updated according to product life cycles and that obsolete products are properly out-phased.

This means that effective implementation of the product development process not only enables management to coordinate the efficient flow of new products, but also assists to support ramp-up of manufacturing, logistics, marketing, and other related activities supporting the commercialization of the product. For this reason, companies need to address all these issues in parallel to be successful and this requires some type of integrative product development approach. Based on the most recent articles that have addressed design from a SC view [23-27] we propose the following definition for this integrative product development approach: “Design for the SC referring to design as a key element of the product development process and is concerned with designing the product, whilst taking into account the impact on the performance and success of the SC”. This approach requires a better understanding of the design process and the way it is integrated with other key functions in the company and in the extended enterprise. It is often stated that the SC starts on the drawing board. However, today’s global competition requires that the SC starts with impulses to new products and services coming from the customer insight process. For example, impulses for innovative product design at Electrolux come from the “Spark process”, which is part of their consumer insight process. Electrolux Product Flow Management is a kind of concurrent design approach and takes a process-oriented view of the whole flow “from the cradle to the grave”. This means that several functions are involved in a concurrent approach to design, development and innovation [28-29]. Hence, the entire process from customer insight to the phase out of the product has to be taken into account. The process has to be looked at from an end-to-end perspective. This, of course, cuts across a lot of internal and external boundaries. Boundary spanning was the focus of traditional business process management (BPM) approaches. However, the results have been rather meager. Success requires a shift of focus from simple mapping, simplification and coordination of processes to full-scale cooperation and collaboration based on Information and Communication Technology (ICT). New tools, such as Service Oriented Architecture (SOA) and Event Driven Architecture (EDA) enable alignment and integration on operational, tactical as well as strategic levels [30].

This research shows how product development is structured and executed in an international manufacturing company, so that an innovative, predictable, and efficient product development may be realized. Case study findings reveal that the case company after implementing a strategic and structured PCP has improved the efficiency and effectiveness of product development. Improved effectiveness means that it to a larger extent develops products that their customers demand, while improved efficiency means that it develops more products, faster with a lower cost than before. The research has also shown that successful product development requires a holistic view from strategy to product design as well as profound knowledge of customers and their requirements. However, it can be concluded that the case company of this research work has not yet developed this kind of linkages between product development and SCM, since the PCP mainly focuses on products and product attributes. The major issue is that
questions concerning how to sell and introduce new products on the market as well as how to distribute them to customers (i.e. customer service) are not considered in the PCP. Still, the case company has become aware of this issue due to problems associated with the lack of integration between product development and SCM. Moreover, it has realized that this issue is increasingly important in the mature consumer markets in which it operates, where outstanding purchasing and logistics solutions is a success factor. An interesting aspect for further research is the above highlighted integrative product development approach. Two major issues should be addressed in such a research approach: (1) how do we define and develop innovative, value adding products? The answer to this question requires that we investigate how the customer insight process is performed and integrated in the design and development of products; and (2) how do we design, develop and manage responsive SCs with the design and development function as an integral starting point?

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