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New Product Development and Its Applications in Textiles

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ABSTRACT

New product development is one of the riskiest, but most critical strategies in any competitive industry (Cooper, 2001). Many companies have built competitiveness and obtained tremendous profits through new product development. Global competition in the textile and apparel industry has become more intense due, in part, to the changes in regulation of world trade. To compete in the future of textiles and apparel, firms will need to be innovative, while reducing cycle times and cutting costs. New product development methods will contribute or enhance the marketing of innovative products. The purpose of this paper is to review the nature of new product development (NPD) and explore diverse NPD processes identified by previous researchers. This paper will also introduce several examples of new product development process models and strategies of companies and products in the textile and apparel industry. This research will be of interest to academicians and industrial personnel in the textile and apparel field through a review of NPD literature.

Keywords: New product development, innovation, NPD process, textiles and apparel

1. Introduction

Today, the world is characterized by macro- and micro-environmental influences. These influences include the rapid evolution of socio-cultural patterns and life styles, self-awareness and decisional autonomy of consumers, a rising significance of mass production and distribution systems, an incessant introduction of technological and managerial innovations, increasing levels of competition and globalization dynamics (Ciappei & Simoni, 2005). These influences are impacting the textile and apparel industry, creating diverse marketplace opportunities and challenges.

The following list shows many of the major trends currently affecting the global textile and apparel industry:

- China dominates apparel and textiles.
- High-tech and smart fabrics proliferate.
- Supply chain management (SCM) evolves to serve the global market.

- The vast majority of shoes sold in the U.S. are now made in China.
- Bricks, clicks, catalogs and living rooms.*
- Discount clothing retailers see promise in designer lines.
- Haute couture designers experience conflicts over costs and control.
- Mass designers and retailers speed up for fast fashion.
- European strategies force U.S. department stores to rethink their business models.
- Specialty retailers look forward, and to the past, for new ideas.

Source: Plunkett Research, Ltd. (n.d.). Retrieved June 30, 2005, from http://www.plunkettresearch.com.

* *'Bricks, clicks, catalogs and living rooms' refers to a traditional retail store, home shopping through a TV cable network and mail order catalogs, and electronic commerce through the internet.*

In order for companies to effectively build and sustain competitiveness in the global textile and apparel industry, they are implementing several strategies. One key strategy is to develop capabilities in product innovation and new product development (NPD). It is also evident that companies require a clearly defined and effective new product development process to compete in the global industry.

This paper defines new product development (NPD), and reviews the key issues in NPD, and several representative NPD process models. In addition, examples of new product development processes and strategies in the textile industry are presented.

2. Definition of New Product Development

2.1 New product

A new product concept, as defined by Crawford and Di Benedetto, is "a statement about anticipated product features (form or technology) that will yield selected benefits relative to other products or problem solutions already available" (Crawford & Di Benedetto, 2003, p. 184). According to Belliveau, Griffin and Somermeyer (2002), a new product is defined as "a product (either a good or service) new to the firm marketing it. It excludes products that are only changed in promotion" (p. 450). Cooper (2001) explains that a new product is defined as new if it has been on the market for five years or less, and includes extensions and major improvements.
According to Cooper (2001), Crawford et al. (2003), and Kumar and Phrommathed (2005), a new product can be classified into several different categories. Booz-Allen and Hamilton (1982) have identified approximate percentages of new product types (See Figure 1).
The followings are commonly accepted new product categories.

1) New-to-the-world products: Products that are innovations

"New-to-the-world products revolutionize existing product categories, or define wholly new ones" (Crawford et al., 2003, p. 12). These new products may include an innovative technology and require consumer instruction. Cooper (2001) states that these new products are the first of their kind and create an utterly new market. This category represents only 10 percent of all new products. For example, new-to-the-world products are Polaroid® camera, rayon fiber, and Sony Walkman®.

2) New category entries (New product lines): Products, not new to the world, that take a firm into a new category

The new category is an imitation of an existing product ("me-too") and provides entrance into new markets for a company. Even though the product already exists in the market, if a firm introduces the identical product into the market, it can be considered a new product. About 20 percent of all new products fit into this category (Cooper, 2001). This category, for instance, includes Procter and Gamble's first shampoo, Hallmark gift items, AT&T Universal card, and Luvs® diapers.

3) Addition to product lines: Products that are line extensions

According to Cooper (2001), these categories are new items to the firm, but they fit within an existing product line that the firm already produces. Kumar and Phrommathed (2005) report that these categories are the new products that supplement the firm's established product lines. Thus, this category contains products that are line extensions or flankers such as Tide™ liquid detergent, Bud Light™, Apple's Mac IIsi® (Crawford et al., 2003), and DKNY®. This category is one of the largest categories of new products and accounts for approximately 26 percent of all new product launches in 1982 (Cooper, 2001).

4) Product Improvements: Current product made better

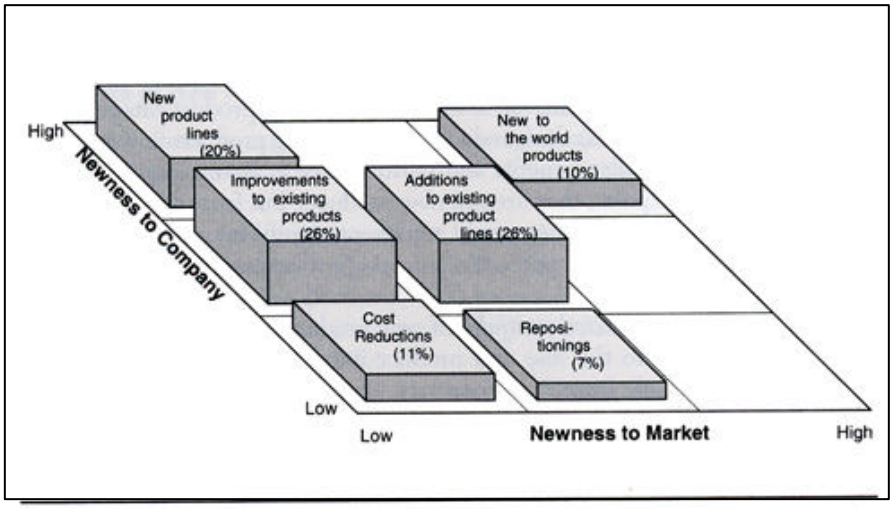
Practically, every product on the market today has been improved. These "not-so-new" products can be replacements of existing products in a company's product line. However, they provide enhanced performance or greater perceived value over the old product (Crawford et al., 2003). These products make up 26 percent of all new products (Cooper, 2001) and examples include Honda Civic Hybrid, Microsoft® Windows® XP, Netzero® high-speed 3G, and Shima Seiki's First® seamless knitting machine.

5) Repositioning: Products that are targeted for a new use or a new application

Repositioning, a new application for an existing products, is selecting a new market place, solving a new problem and/or serving another market need. Aspirin, for instance, was the standard headache and fever reliever. However, since a new medical benefit was discovered for aspirin, aspirin is now positioned as a headache reliever as well as a preventer of blood clots, strokes and heart attacks (Cooper, 2001). As one example in the textile field, the American Fiber & Yarns Company applied polypropylene fiber, whose main application has been upholstery and industrial textiles, into new market segment, the knitted apparel market. This repositioned category accounts for about 7 percent of all new products (Cooper, 2001).

6) Cost reductions: Products that are designed to replace existing products at lower cost

New products that provide a cost reduction, can replace existing products in the line, but can offer similar benefits and performance at a lower cost. They represent 11 percent of all new product launches in 1982 (Cooper, 2001). Examples of this category are eMachines® desktop computer, Flying Tiger® hand knitting machine, and acrylic. For instance, acrylic fiber that approximates the hand of wool can replace wool (Hoechst, 1990) and is offered at a lower cost in the market.



SOURCE: Booz-Allen & Hamilton, *New Product Management for the 1980s* (New York: Booz-Allen & Hamilton, Inc., 1982).

Figure 1. Categories of New Products

Source: Cooper R. G. (2001). *Winning at New Products* (3rd ed.). New York: Addison-Wesley. p. 16.

Recently, Kumar et al. (2005) surveyed five new product categories including new-to-the-world, new-to-company, addition to existing lines, repositioning, and cost reduction. The study's results found that 31.68 percent of launched products fall into 'addition to existing lines' category (Kumar et al., 2005). The cost reduction category was in second place with 22 percent of all new launches, followed by new-to-company, market repositioning, and new-to-the-world consecutively (Kumar et al., 2005).

2.2. New Product Development

New product development is essential for exceptional corporate performance, and research about what leads to new product success and failure has been carried out for both goods and services (Brentani, 2001). Ulrich and Eppinger (2004) describe New Product Development (NPD) as "the set of activities beginning with the perception of market opportunity and ending in the production, sale, and delivery of a product" (p. 2). According to Belliveau et al. (2002), new product development is "the overall process of strategy, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product" (p. 450).

New product development can be rewarding and is critical to maintain a healthy organization. Cooper (2001) indicates, "New product development is one of the riskiest, yet most important, endeavors of the modern corporation" (p. 4). Successful new product development allows market expansion, increases profits, and enhances creativity and leadership. But, new products failure rates are considerable, and cost of failure is high. According to Booz-Allen and Hamilton (1982), the failure rate of new products introduced into the market remained in the 33 percent to 35 percent range between 1963 and 1981 (Urban & Hauser, 1993). More recently, Crawford et al. (2003) reported that around 40 percent of new products fail. The foremost reasons for new product failure is "no need for the product", and "there was a need, but the new product did not meet that need" (Crawford et al., 2003, p. 7). Failures also can be linked to poor market research, poor

positioning, inadequate support from the distribution channel, poor timing, competitive response, and major changes in technology (Urban et al., 1993).

New product development can also be costly. Enormous investments in research and development (R&D), engineering, market research, marketing development, and testing are made before the product is launched (Urban et al., 1993). These are major investments or major resource allocations for a company including capital resources and human resources; and with today's global competitive marketplace, many companies are closely watching expenditures.

2.3. Key NPD Functions and Cross Functional Integration

Development of new products is an interdisciplinary activity requiring contribution from nearly all the functions of a company (Ulrich et al., 2004). The following functions are consistently essential to new product development projects:

1) Marketing

The functions of marketing mediate the interactions between the firm and its customers. Marketing facilitates the recognition of product opportunities, the definition of market segments, and the identification of customers' needs (Ulrich et al., 2004). Marketing also arranges for communication between the firm and its customers, sets target prices, and oversees the launch and promotion of the product (Ulrich et al., 2004).

The latest market research has been recognized as important to the success of new product development. It is essential to identify early market requirements and to understand the market place. Marketing is related to all stages of the new product development process, from product planning, screening, and testing through launch (Bruce et al., 1995).

2) Design

The design function also plays a pivotal role in defining the physical form of the product to satisfy customers' needs. The design function includes engineering design such as mechanical, electrical, software, and industrial design such as aesthetics, ergonomics, and user interfaces (Ulrich et al., 2004).

In manufacturing, industrial design has become a key factor in differentiating products from their competitors by providing them a coherent identity or higher levels of perceived value (Bruce et al., 1995). Engineering design has a critical role in the development of products in the manufacturing industry, solving technical problems using available technology in the most efficient method, and integrating product development with the requirements of effective production (Rothwell & Gariner, 1984).

3) Manufacturing

Manufacturing is responsible for creating and operating production systems in order to produce new products. However, broadly defined, the manufacturing function also often involves purchasing, distribution, and installation (Ulrich et al., 2004). Manufacturing capability can be one technical success factor, and it relates to whether the company has internal or external capability to manufacture higher quality products to satisfy the customer demand (Crawford et al. 2003).

4) Finance

Another key function that influences the success of the new product development process is financial activity. Projects need to be suitably supported; yet checks on cost, profit margins and return on investment must be part of the process (Hopkins, 1981).

Many companies utilize phase reviews to keep a check on the progress of the projects, the budget and the authorization to spend (Bruce et al., 1995).

2.3.1. Cross-Function Integration

Cagan and Vogel (2002) and Urban and Hauser (1993) comment that a true integration of engineering, industrial design, marketing and finance is important as well. Figure 2 depicts cross-functional integration with arrows showing the major interactions. According to Urban and Hauser (1993), marketing must offer research and development (R&D) correct customer need inputs, and R&D must design a product to fit customers' requirements. However, research and development must also design a product that can be manufactured at high-quality levels and low cost. Research and development (R&D) and engineering must work to innovate the process of manufacturing as well as design new products. Finally, finance interacts with R&D, manufacturing, and marketing when financial resources are required (Urban et al., 1993).

It is necessary to note that boundaries between the functions are not always clear. All the functions must work together, and all activities share the responsibility to produce successful products.

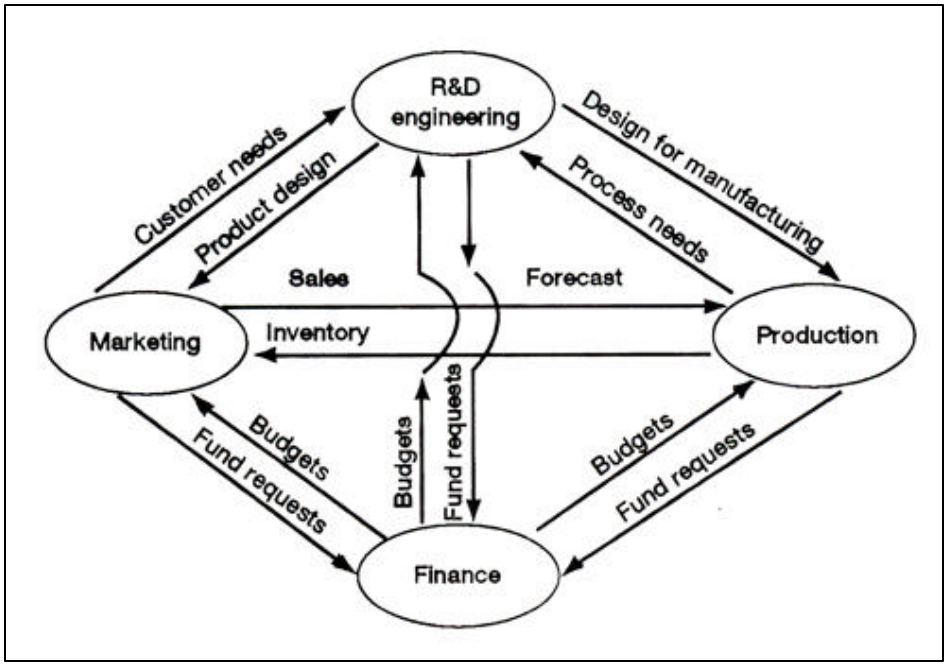


Figure 2. Cross-Function Integration

Source: Urban, G. L. & Hauser, J. R. (1993). *Design and Marketing of New Products* (2nd ed,). New Jersey: Prentice-Hall. p. 33.

2.4. Successful New Product Management

The main issues of new product development relate to the need for interdisciplinary inputs, for quality input, for cost input and for speed in the process (Bruce et al., 1995). The inputs that contribute to the value of new products tend to conflict with each other, but there are synergies (Crawford et al., 2003, See Figure 3).

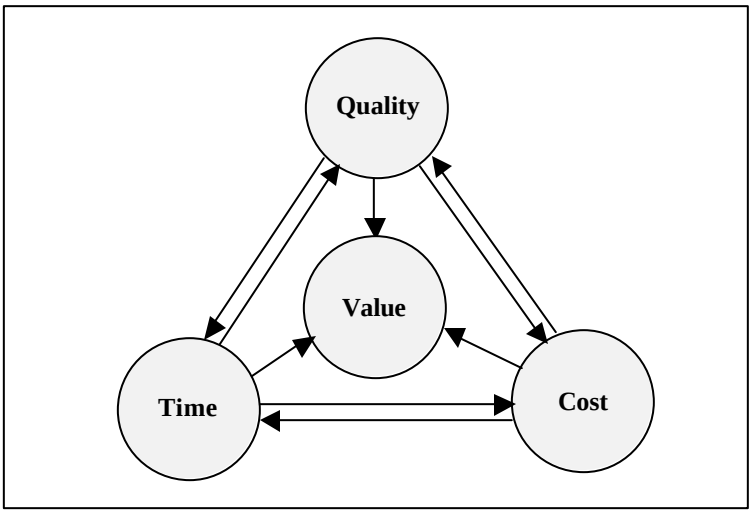


Figure 3. The Conflicting Masters of New Products Management

Source: Crawford, M. & Di Benedetto, A. D. (2003). *New Products Management* (7th ed.). New York: McGraw-Hill. p. 15.

- Product *Quality*: Successful product development depends upon how good the product is, whether the product satisfies customers' needs, and whether the product is robust and reliable. Product quality is ultimately reflected in market share and the price that customers are willing to pay (Ulrich et al., 2004).
- Product *Cost*: Successful product development also relies on the manufacturing cost including spending on capital equipment and tooling as well as the incremental cost of producing each unit of the product. Product cost determines how much profit accrues to the firm for a particular sales volume at a particular sales price (Ulrich et al., 2004).
- Development *Cost*: Successful product development also depends on how much the firm has to spend to develop the product. Development cost is usually a critical portion of the investment required to attain profits (Ulrich et al., 2004).
- Development *Time*: How rapidly the team completes the product development effort is also an important issue. "Development time determines how responsive the firm can be to competitive forces and to technological development, as well as how quickly the firm receives the economic returns from the team's efforts" (Ulrich et al., 2004, p. 2-3).
- *Value*: The inputs of quality, cost, and time contribute to the value of product. The challenge is to optimize the set of relationships in each new product situation to get higher value of the products (Crawford et al., 2003).

2.4.1. Critical Success Factors for New Product Development

The most important issue in the success of new product development is to understand the voice of the customer in terms of

perceived requirements and to set up a relationship between the customer input and how products are designed, produced, and managed (Urban et al., 1993). Voice of the customer (VOC) has been examined by several researchers (Cooper, 2001; Crawford et al.; 2003; Ulrich et al., 2004; Urban et al., 1993). Products can be sold when customers find them to be superior, of higher value, or unique, and when a firm can deliver the perceived benefits more effectively than competitors. Success in new product development also depends on whether the target market segment is sufficiently large and competition is manageable (Urban et al., 1993). Therefore, it is crucial to identify the target market segmentation before the significant activity of designing and producing a product.

Sun and Wing (2005) summarized critical success factors for new product development identified by previous researchers as seen in Table 1. In general, common factors across the four studies include top management support for the team, long term strategy with innovation focus, and a structured new product development process. However, the factors proposed by the four different studies are not all exactly the same. For example, Cooper (1999) has pointed out the significance of "go/kill decision point into the NPD process" as one of the critical success factors while others did not.

Critical success factors			
Lynn et al. (1999)	Having a structured new product development process	Poolton and Barclay (1998)	Top management support for innovation
	Having a clear and shared vision on the team		Long-term strategy with innovation focus
	Developing and launching a product within the proper time frame		Long-term commitment to major projects
	Refining a product after launch and having a long-term view		Flexibility and responsiveness to change
	Possessing the optimal team skills		Top management acceptance of risk
	Understanding the market and its dynamics		Support for an entrepreneurial culture
	Securing top management support for the team and the team's vision	Cooper (1999)	Solid up-front homework to define the product and justify the project
	Applying lessons learned from past projects		Build in the voice of the customer
	Securing good team chemistry		Seek differentiated, superior product
	Retaining team members with relevant experience		Sharp, stable, and early product definition
Lester (1998)	Senior management commitment		A well-planned, adequately researched, and proficiently executed launch
	The culture of the organization		Build tough go/kill decision points into your process
	Cross-functional teams		Dedicated, supported cross-functional teams with strong leaders
	Focus on adding value to the efforts of the venture team		An international orientation: international teams, global products
	Provide strategy and fundamental guidelines		Provide training on new product management
	Share a common understanding of the process		Define standards of performance expected
	Innovation requires expertise, skills, and motivation		Cut back the number of projects underway
	Generating good ideas		Install a process manager
	Team formation events		
	A detailed project tactical plan		
	Clear goals and milestone measurements		
	Shift to an external focus to run the new product venture		
	Understanding in the venture team		
	Communication to management		
	The insight gained through reassessment efforts		

Table 1. Critical Success Factors for NPD Identified by Previous Researchers

Source : Sun, H. & Wing, W. C. (2005). Critical Success Factors for New Product Development in the Hong Kong Toy Industry. *Technovation.* 25. p. 295.

Sources used:
Cooper, R. G. (1999). From Experience: The invisible Success Factors in Product Innovation. *Journal of Product Innovation and Management*. 16(2).
Lester, D. H. (1998). Critical Success Factors for New Product Development. *Research Technology Management.* 41(1).
Lynn, G. S., Abel. K. D., Valentine, W. S., & Wright, R. C. (1999). Key Factors in increasing speed to market and improving New Product Development Rates. *Industrial Marketing Management*. 28.
Poolton, J. & Barclay, I. (1998). New Product Development from Past Research to Future Application. *Industrial Marketing Management.* 27.

2.5. Key Research Issues in New Product Development

New Product Development researchers have examined key research issues such as market orientation, innovation management, supply chain management, project risk management, globalization, alliances, time-to-market management, and cost analysis. Three main research issues (market orientation, innovation management, and time-to-market management) recognized as most important new product success factors will be discussed.

2.5.1. Market Orientation

Researchers (Langerak, Hultink & Robben, 2004; Tyler & Gnyawali, 2002; Wren, Souder & Berkowitz, 2000) have explored the role of market orientation in determining new product success. According to Wren et al. (2000), "Market orientation is the set of cross-functional processes and activities directed at creating and satisfying customers through continuous needs assessment" (p. 602). Tyler et al. (2002) defined market orientation as "the organization-wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization wide responsiveness to it" (p. 260). Through proper market orientation, the firms can gain a better understanding of customer needs and wants, and a great knowledge of competitor activities and market trends (Wren et al., 2000). Naver and Slater (1990) have conceptualized market orientation as a composite of three behavior components: customer orientation, competitor orientation, and interfunctional coordination (Tyler et al, 2002).

1) Customer Orientation and Competitor Orientation

According to Tyler et al. (2002), customer orientation and competitor orientation include all of the activities involved in acquiring information about the customers and competitors in the target market and disseminating it throughout the business. Whereas proactive firms identify and respond to long-term customer needs and thus become more customer-oriented, reactive firms identify and respond to competitor's actions and thus are more competitor-oriented (Frambach, Prabhu & Verhallen, 2003). However, Naver, Slater, and MacLachlan (2000) point out, "A market orientation, whether reactive or proactive, is the foundation for a firm's innovation effort" (p. 11).

2) Interfunctional Coordination

Interfunctional coordination, positively related to market orientation and new product success, is a structural aspect of an organization facilitating communication and coordination between firm's different functions (Tyler et al., 2002).

2.5.2. Innovation Management

Brentani (2001) states, "Innovation involves the creation of a new product, service or process" (p. 170). Although innovation is very risky and uncertain, and requires expensive endeavors (Cormican & O'Sullivan, 2004), it plays a vital role in

increasing organization's competitive power. Many researchers (Astebro & Michela, 2005; Cormican et al., 2004; De Brentani, 2001; McDermott & O'Connor, 2002) have identified the need for innovation management in new product development. Key factors that were found to facilitate innovation management consist of strategy and leadership, information and communication, and planning and selection.

1) Strategy and Leadership

Strategy and leadership have been identified as the first critical success factors to enable effective innovation management. According to Cormican and O'Sullivan (2004), a product strategy should define the aims and objectives of the product innovation effort related to the company's overall business strategy. A product strategy should also focus and integrate team effort and permit delegation (Cormican et al., 2004). While every member in the project team has an input into product innovation, leaders appear to have an imperative impact on product innovation initiatives. A leader's role is to create a vision and effectively communicate it by setting obvious objectives (Cormican et al., 2004).

2) Information and Communication

Another key factor identified for successful innovation management is organizational information and communication process (Van Riel, Lemmink, & Ouwersloot, 2004). Scholars (Allen, 1985; Clark & Fujimoto, 1991; Souder, 1992) in the field of innovation have traditionally viewed innovation as an information processing activity (Moenaert, Caeldries, Lievens, & Wauters, 2000). The innovation team attains information on markets, technologies, competitors, and resources, and translates the information into a product design and strategy (Moenaert et al, 2000). Thus, innovation success is related to how well companies gather and diffuse information (Van Riel et al., 2004), making communication an essential necessity for product innovation especially when team members are geographically distributed (Cormican et al., 2004).

3) Planning and Selection

A rational planned innovation effort is also important for company's success. It is necessary to effectively plan and select projects, which are customer focused and linked to the new product strategy and goals (Cormican et al., 2004). Because contemporary organizations must be customer driven (Cooper, 1999), it is critical to clearly understand user needs, and all plans and selections should fit with the customer needs or projected future needs.

2.5.3. Time-to-Market

Researchers (Bayus, 1997; Cooper & Kleinschmidt, 1994; Skerlj & Prasnikar, 2005; Smith, 1999) also have documented the importance of time-to-market in new product development. According to the researchers, how fast a new product can be developed and brought to market determines its ultimate success or failure. McGrath (2004) comments that decreased time-to-market provides numerous benefits such as gaining higher productivity, reducing the costs of many projects, and enabling time-based competition.

1) NPD Cycle Time

Reducing new product development (NPD) cycle time can create relative advantages in market share, profit, and long-term competitiveness (Sanchez & Perez, 2003). How then do companies reduce NPD cycle time in product innovation? According to Griffith (1993), "Decreasing product/project complexity and the introduction of a systematic new product process significantly reduce cycle times" (Cooper et al., 1994, p. 382). Smith (1999) comments that skipping steps can be one of the tools of rapid development. In the fashion apparel industry, firms that concentrate on

producing copies referred to as knockoffs, or adaptations of products already on the market, can reduce the amount of time required to complete the process (Keiser & Garner, 2003) because they skip some of NPD processes (steps) including opportunity identification and design and development processes.

2) First-to-Market

Companies with 'first to market' products capture the market, enjoy a high market share, create barriers to entry for the competition and create brand awareness for their product (Prasnikar et al., 2005). Carrillo and Richard (2004) state, "An innovating first entrant gains a monopoly that yields premium price until a competitor's eventual entry drives prices down. Conversely, delays in bringing products to market can be devastating" (p. 2).

3) Quick Changes in both Technology and Customer Needs

How quickly the product can be changed to fit with technology and customer needs is also an important issue in new product development (Cooper et al., 1994). Especially, in the textile and apparel industry, it is critical to effectively recognize and adapt to quickly changing trends in the market (Keiser et al., 2003).

3. New Product Development Processes

A new product development process (NPD Process) is defined as "a disciplined and defined set of tasks and steps that describe the normal means by which a company repetitively converts embryonic ideas into salable products or services" (Belliveau et al., 2002). Ulrich et al. (2004) state, "A new product development process is the sequence of steps or activities that an enterprise employs to conceive, design, and commercialize a product" (p.12). Several researchers have developed new product processes for use with assorted products.

Table 2 is a summary of the previously presented new product development processes. For organizational purposes as well as illustrating how complex new product development process have become, Urban and Hauser's process was selected as the first product development process in Table 2, and each of the activity categories of other new product development processes are aligned vertically.

However, it is important to note that "in practice many of activities of the phases will be going on simultaneously, and interaction will be common" (Urban et al., 1993, p. 50). Compared to the sequential process, simultaneous (overlapping) phases of development reduce time to market and smooth the transition between phases. Therefore, it is critical to be aware that the product development process is a multi-cross-functional program, where all functions work together to accomplish the required task (Crawford et al., 2003).

Each new product development process model in Table 2 consists of the different process arrangements. For example, Urban and Hauser (1993) describes a five step decision process model while Trott's (2002) NPD process is composed of eight-steps. Nevertheless, all new product development process (NPD) models have similarities in the key activities and functions. Even though all new product development process models use the different step terminologies, the process begins with perception of market opportunities and typically involves identification of customers' needs, design development process, product and market testing, and market launch. In addition, all the processes or activities are multidisciplinary within different company organizations.

Many other researchers (Barclay, Holroyd & Poolton, 1995; Cooper & Kleinschmidt, 1986; Erhorn & Stark, 1994; Gruenwald, 1992; Hart & Baker, 1994; Himmelfarb, 1992; Rosenthal, 1992; Saren, 1994) also have developed new product processes

which are reviewed in May-Plumlee (1999). These NPD process models also have similarities to those detailed here.

	1			2			3	4	5
Urban and Hauser	Opportunity Identification			Design			Testing	Introduction	Life Cycle Management
Ulrich and Eppinger	Planning	Concept Development		System-Level Design	Detail Design		Testing and Refinement	Production Ramp-up	
Crawford and Di Benedetto	Opportunity Identification & Selection	Concept Generation		Concept/ Project Evaluation	Development			Launch	
Cooper	Discovery	Scoping		Build Business Case	Development		Testing and validation	Launch	Post Launch Review
Bruce and Biemans	Idea Generation	Screening	Concept Development	Marketing Strategy	Business Analysis	Product Development	Market Testing	Commercialization	
Trott	Idea Generation	Idea Screening	Concept Testing	Business Analysis		Product Development	Test Marketing	Commercialization	Monitoring and Evaluation

Table 2. New Product Development Processes

Author : Choi, W. (2005).

Sources used :

Urban, G. L. & Hauser, J. R. (1993). *Design and Marketing of New Products* (2nd ed.). New Jersey: Prentice-Hall.

Ulrich, K. T. & Eppinger, S. D. (2004). *Product Design and Development* (3rd ed.). New York: McGraw-Hill.

Crawford, M. & Benedetto, A. D. (2003). *New Products Management* (7th ed.). New York: McGraw-Hill.

Cooper R. G. (2001). *Winning at New Products* (3rd ed.). New York: Addison-Wesley.

Bruce, M. & Biemans, W. G. (1995). *Product Development – Meeting the Challenge of the Design-Marketing Interface.* New York: John Willey & Sons.

Trott, P. (2002). *Innovation Management and New Product Development* (2nd ed.). London: FT Prentice Hall.

4. New Product Development in Textiles and Apparel

Examples of new product development in textiles and apparel exist with several companies and products with diverse textile end uses. Research and trade literature identified various new product development processes and strategies. The following illustrations are examples of new product development processes in the global marketplace.

4.1. Glen Raven, Inc.

Glen Raven, Inc., a North Carolina – based company, is one of the world's largest technical textile specialists. Glen Raven is privately held with continuous family ownership over 125 years in the textile industry (McCurry, 2004). Since its founding in 1880, the company has successfully developed numerous new textile products including 100% solution-dyed acrylic fabric and the first pantyhose (tights). The company also has produced products for diverse end use such as awnings, automotive textiles, patio furniture seat covers, advertising graphics or sails on luxury yachts (Glen Raven Inc., 2005, See Figure 4). Currently, Glen Raven is organized with divisions including Technical Textiles, the Filament Fabric group, Sunbrella® and International (through Dickson® acquisition).

Glen Raven, Inc., recently, has earned the 2005 Textile World Innovation Award through empowering its associates to be innovators, developing a culture of market-driven innovation and carefully building a global approach to business (Borneman, 2005). The Sunbrella® brand of performance fabrics focuses on innovation for awnings, furniture, marine and convertible car tops. Glen Raven Technical Fabrics markets performance fabrics for automotive, protective apparel, military and marine applications (Glen Raven, 2005). Glen Raven's success depends on a proactive strategy including aggressive investment for marketing strategy and innovation as well as global expansion. Sections 4.1.1 to 4.1.4 present how the company has repeatedly retooled and realigned itself to maintain its profitability and viability for over 100 years in the textile industry.

Figure 4. Numerous Glen Raven's Applications

Source: Glen Raven Inc. (n.d.). Retrieved June 22, 2005, from http://www.gleraven.com

4.1.1. Innovation

Allen Gant Jr., President of the company points out, "The key to innovation is lack of fear" (Rivas, 2005, p. A1). The company has heavily invested the latest technology and has a penchant for innovation (McCurry, 2004). In recent years, the company implemented a program called "GlenOvation" (Rivas, 2005). According to Rivas (2005), the "GlenOvation" program, an internal program designed to involve every associate in the innovation process, rewards workers for any innovative ideas

that they offer. John Coates (2005), Director of Research and Development at Glen Raven Inc., comments, "We have seen tremendous commitment from our associates around the world, and we are now funding several new ideas that have great potential in their intended markets. As we continue to nurture these ideas and have market success, we feel the momentum will continue to grow in support of GlenOvation" (Borneman, 2005, www.textileworld.com). Glen Raven is aware of the importance of creative ideas for new product development.

4.1.2. Marketing Strategy

Marketing strategy plays a critical role at Glen Raven, not just in supporting successful brands, but in understanding markets and guiding Glen Raven's investment direction (Borneman, 2005). Borneman (2005) explains, "Few textile companies understand and act on market data the way Glen Raven does to continually reposition assets and make tough decisions on entering and exiting markets" (p. 20). The company has the capability to adjust to change that has kept it alive through good times and bad (Rivas, 2005). Glen Raven Inc., as recently as six years ago, was 50 percent apparel, and today it is less than 3 percent apparel. It shows that the company does not get bound up in tradition or past successes (Borneman, 2005).

The company's aggressive investment in supporting its marketing strategy is reflected in various examples including research and development, and testing. A few years ago, the company invested one million dollars in improving its testing facilities to become fully certified to test fabrics (McCurry, 2004).

4.1.3. Globalization

Currently, Glen Raven, Inc. has expanded to 127 countries around the world (Borneman, 2005). The company searches for healthy and growing markets with room for Glen Raven to succeed. It builds brands and barriers to entry by competitors, and thoroughly defends those markets with marketing strategy programs (Borneman, 2005).

The company learned how to expand globally when they acquired Dickson S.A., France, and recently embarked on building a plant in China (Borneman, 2005). From a global perspective, it was the action that gave the company a more global emphasis than anything else it had ever done. Now, the company has about 40 percent of their operations outside the United States within different cultures (Borneman, 2005).

4.1.4. Voice of the Customer

In particular, Glen Raven considers the significance of the voice of the customer (VOC) for their products. The company endeavors to identify customers' requirements and to develop the high quality product that exceeds customer expectations (Glen Raven, 2005). To satisfy customers' expectations, the R&D team at Glen Raven spends time with sales force, attends trade shows, and interacts with customers.

4.2. Freudenberg Nonwovens

Freudenberg Nonwoven Group, a wholly owned family enterprise headquartered in Germany, is the world's largest manufacturer of nonwoven goods. The company retained number one world ranking in annual sales of nonwoven industry in 2003, at an estimated 1.4 billion dollars (Bitz, 2004). Freudenberg Group consists of 17 production facilities located in 12 different countries including Argentina, Brazil, China, Germany, Italy, Japan, South Africa, South Korea, Spain, Taiwan, the UK, and the USA (Bitz, 2004). The company employs the five core divisions – interlinings, filtration, hygiene/medical, technical nonwovens and tuft (Nonwovens Industry, 2003), and its divisions involve numerous markets from apparel interlinings, automotive interior trims, hygiene products, to carpet backings. Freudenberg's five divisions are now independently responsible for product development, marketing, sales and services as well as for its own production, plants and production lines

(Nonwovens Industry, 2004). Thus, each division is capable of operating independently while they still profit from the advantages of a large company such as technology, purchasing power, financial aid, and human resources (Nonwovens Industry, 2003).

4.2.1. Value for customers and Innovation

Freudenberg's key focus is to anticipate, understand and meet customers' needs and expectations (Freudenberg, 2005). In order to satisfy customers' demands, the company concentrated on modernizing the product line and a corporate restructuring program (Bitz, 2004). The restructuring program was designed to enable the company to react more quickly to customers' requirements and market trends (Bitz, 2004). The company believes that it is essential to provide innovative products and a high level of value added service to customers to remain competitive in the market (Freudenberg, 2005).

Freudenberg is also aware of the importance of supplying innovative products. They consider that constant innovation in everything they do is critical for their long term financial success (Freudenberg, 2005). For example, in the filtration division, the company identified demands for fine filtration products that help to improve the environment and public health. They then developed and expanded filters (MicronAir™ cabin air filters) for the removal of odors available for household, automotive and industrial end use (Bitz, 2004). Freudenberg plans to invest in the construction of a new line for making MicronAir™ cabin air filters in Germany (Bitz, 2004). Freudenberg invested 40 million dollars to build new product development lines for total five different divisions (Bitz, 2004). Stephan Tanda, a president and CEO, states, "Success for us will come through differentiated technology and tremendous diversity both when it comes to roll good production, finishing, and converting. We use our broad set of industry expertise to follow the growth of our customers" (Nonwovens Industry, 2004).

4.2.2. Global Alliances and Partnership

Freudenberg has a long successful tradition of global cooperation, alliances and partnership which enable better serve customers as well as strength its competitive position (Freudenberg, 2005). According to Deeds and Rothaermel (2003), successful management of strategic alliances and partnership has become vital to firms' new product development and eventually to firm performance. Freudenberg has experienced numerous alliances and joint ventures with international partners. For instance, in the interlining division, Freudenberg has achieved a long term relationship with the Japan Vilene Company. This relationship has allowed Freudenberg to match its capacity in Asia to the market needs, and to maintain a production cost structure comparable with local producers (Nonwovens Industry, 2004).

In July 2001, Freudenberg and Frisby Technologies formed a joint venture. Under the joint venture agreement, Freudenberg created nonwoven material whereas Frisby was responsible for product manufacturing and marketing (Bitz, 2004). In June 2003, Freudenberg acquired a 100% share of ComfortTemp® products from Frisby Technologies based in Winston-Salem, North Carolina, USA (Bitz, 2004). In May 2004, in order to enhance competitiveness in the filtration market in China, there was another joint venture between Freudenberg, Japan Vilene, and local Chinese partners. The joint venture supplies motor and cabin air filter housing as well as filter elements to leading automotive manufacturers in North and Western China (Nonwovens Industry, 2004). The international joint venture provides numerous benefits to the company and its partners such as sharing relevant technologies, increasing companies' capacity of their industry and enhancing the bargaining power (Nakamura, 2005).

4.3. Herman Miller Aeron Chair

Herman Miller, Inc., founded in 1923, is a leading provider of office furniture and services worldwide. The company headquarters is located in Zeeland, Michigan, and Herman Miller operates U.S. subsidiaries in Atlanta, Georgia, and Lake Mills, Wisconsin. The company enhances the working environment through the design, manufacture and distribution of furnishings, interior products, and related services (Herman Miller, 2005). Net sales of $262,000 in 1923 grew to $1.34 billion in fiscal year 2004 (Herman Miller, 2005).

The Herman Miller Aeron Chair is a unique product combining ergonomics, aesthetics, material and manufacturing innovation, and mechanical invention (Herman Miller, 2005). It was a main departure from the competing solutions to office seating. While Aeron Chair was a significant change, it was quickly accepted as a suitable solution to the needs of current office workers (Cagan & Vogel, 2002). Although the retail price of the Aeron chair is expensive (approximately 800 US dollars), the Aeron has witnessed a high degree of success in the market (Cole, 2003). The next section illustrates what Bill Stumpf and Don Chadwick, designers of the Aeron Chair, saw that no one else did, and why Herman Miller was willing to invest in such an untested seating concept.

Figure 5. Herman Miller Aeron Chair

Source : Herman Miller Inc. (n.d.). Retrieved June 27, 2005, from http://www.hermanmiller.com

4.3.1. Opportunity Identification

The two designers began the product development process without any assumption about form or material, but with some strong convictions about what a chair is required to do for a person (Herman Miller, 2005). They recognized new areas of stress on the body from the effects of spending long periods of time seated in the same position. They looked at issues of body temperature, blood circulation, and spinal compression (Cagan et al., 2002). They also recognized that the light and open aesthetic trend had not been applied to seating design. Office seating had been traditionally used as a way to denote the class structure of the office (Cagan et al., 2002). The Aeron endeavored to shift the emphasis from hierarchy to comfort.

Herman Miller was aware that economic issues associated with the kinds of illness and reduced performance was also important (Cagan et al., 2002). Nowadays, keeping employees healthy and functioning has become a big challenge in business. Thus, Herman Miller saw that retaining employees and helping them function at their fullest is more profitable and stable for companies than constantly replacing with new people (Cagan et al., 2002).

4.3.2. Process

The project was initiated by a team (including marketers, designers, an ergonomic research group, and engineers), who began a potential seat design to replace the existing recliners used by senior executives. An early emphasis on ergonomic research of anthropometrics, and issues related to sitting down and getting out of chair was studied (Cagan et al., 2002).

The team focused on new research studies that identified issues related to long-term seating in weight distribution and heat transference. This focus led to the proposal for breathable seating surface design that allows people to retain an even heat distribution in the front and back of chair. After the concept proposal, the team tried to develop the material that prevents heat build up from the body. However, the team recognized that they had to find the right supplier to make the fabric (Cole, 2003). Herman Miller found the Quantum Group Inc. who was able to create a material to meet Herman Miller requirements. Quantum Group, however, overcame manufacturing obstacles in the fabric development through special extrusion methods and other manufacturing methods not typically used in most textile manufacturing plants (Cloe, 2003). Finally, this fabric supplier successfully developed an engineered form-fitting material, which is a weave of elastomeric-based specialty fibers.

The open weave that was developed has the capability to meet the performance demands of a breathable interface between the body and the chair. It also provides ergonomic solutions and unique aesthetics (Cagan et al., 2002). The Aeron Chair offers people a sense of security and safety from a health view point. Office workers feel that they are sitting in a chair designed to fit their body and one which will support them in the variety of tasks they must perform. Therefore, it provides less chance of injury and diminishes potential for the long term-negative effects that most workers face (Cagan et al., 2002).

In design, the Aeron chair is the type of design that no one would have predicted and yet when it debuted everyone responded to it in a positive way. It anticipated the shift away from the need to make people feel important by rank to the need to make them feel comfortable by design. The Aeron chair was developed to fit equally well in a renewed loft space and in new action-oriented open office designs. It also looks elegant in combination with other furnishing in high-end office decor and meeting rooms. As a result, the aesthetic and technical uniqueness does not allow competitors to imitate the chair without looking like they are making a direct rip-off (Cagan et al., 2002). Randy Brown, a Herman Miller product manger, (2003) states, "The Aeron success story required an exhaustive collaboration among several individuals with diverse talents, as well as more patentable ideas than any previous Herman Miller undertaking" (Cole, 2003, p. 14).

4.4. American Fibers and Yarns Company

American Fibers and Yarns Company (AF&Y) was established in 1965 as Phillips Fibers Corporation, developing and producing polypropylene filament yarn for home furnishings and other products. American Fibers and Yarns Company has now become the largest supplier of polypropylene filament yarns in the United States (Rodie, 2004). Headquartered in Chapel Hill, North Carolina, AF&Y maintains a technology center that specializes in engineering filament yarn in innovative combinations not available from other suppliers (AF&Y Co., 2005). Based on its success in the core residential contract and industrial fabric markets, AF&Y is now setting its sights on other applications and markets which include repositioning products towards knit apparel applications (Gross, 2005).

American Fibers and Yarns Company has had success in the home furnishing market

by emphasizing the inherent performance properties of polypropylene fiber. Innova®, developed by AF&Y, is a fiber with characteristics such as light weight, quick drying, durability, resistance to bacteria, the lowest thermal conductivity, abrasion resistance, and low cost (AF&Y, 2005). Recently, the company penetrated the knit apparel market by promoting the benefits of polypropylene (Gross, 2005).

James T. Morelli, an executive vice president at AF&Y, says, "What we have got there is the exact same technology with the same characteristics adapted for the apparel market. We looked at how to replace cotton, rayon, polyester with these products giving the consumer easy care characteristics such as stain resistance and washability. We are also looking at sweaters and dress socks with all the same characteristics" (Gross, 2005, p. 58). In order to easily identify gaps between what customers want and what the characteristics of products are, the company has utilized a matrix described as a radar chart (Apperson, 2004). The radar chart effectively demonstrates what benefits or properties have been found to be important to the home furnishing customer. It also illustrates benchmarking of the home furnishing competition, as well as the opportunities for improvement (See Figure 6).

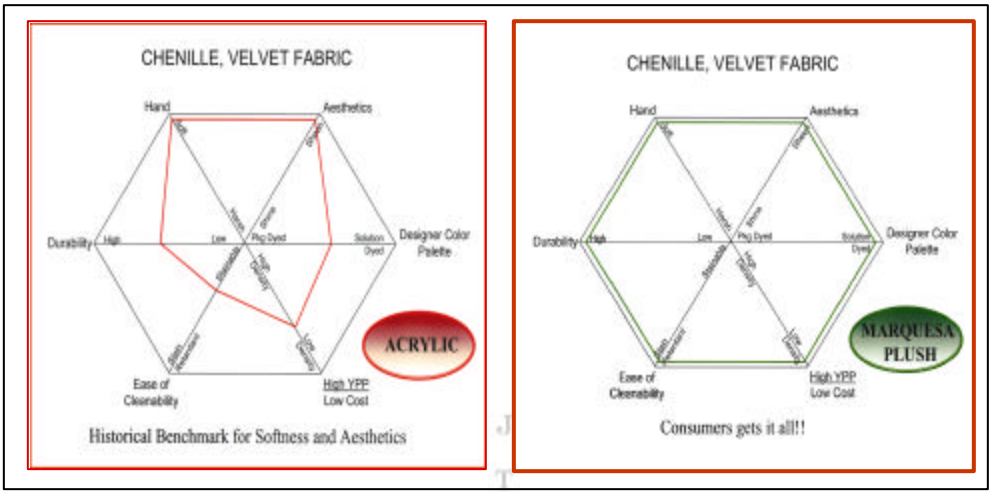


Figure 6. Radar Chart

Source: Apperson, M. (February 12, 2004). Interviewed at headquarter of American Fibers and Yarns Company in Chapel Hill, NC. Promotional material AF&Y

In 1999, AF&Y established the Technology Center in Bainbridge, Georgia., where a team of engineers and technicians perform research and development using state-of-the-art equipment (Rodie, 2004). Morelli states, "Technology development has been an active process for the past three years. Moving forward, it is the foundation of the future of our business" (Rodie, 2004, p. 23).

In the last three years, the company has invested about 3 million dollars in research and development (Gross, 2005). Morelli mentions, "American Fibers & Yarns is one of the few yarn producers investing in technology" (Rodie, 2004, p. 24). He continues, "Our technology includes proprietary chemistry as well as proprietary texturing techniques and processes. We rely on our supplier relationships to continue to develop new technologies for our product lines, and enlist suppliers to help us bring new technologies to market" (Rodie, 2004, p. 24).

4.5. Bandage Group

Barnes and Bruce (2000) introduced the Bandage case study, which mainly provides a study of requirement capture and new product development within an organization. The Bandage Group was founded by an entrepreneur in the 1950s, when he developed ideas to market tubular bandage (Barnes et al., 2000). Since the 1970s, the group has developed its international network and their product has been expanded, with acquisition and development of associated healthcare products, covering several major therapy fields, and continence care (Barnes et al., 2000). However, the new product development at Bandage is not formal. This case study shows how different the theory and reality of new product development may be.

4.5.1. New Product Development Process

Figure 7 illustrates the procedure flowchart for NPD at Bandage. However, in reality their NPD process does not follow formal stages. For example, in theory, the project teams have responsibility for preparing business plans, forecasts, and design stages as part of the NPD process. The information fed into the NPD committee from the project teams should then allow the committee to make go/kill decisions at the each stage-gate. In realty, the stage-gate process is not followed at Bandage. Rather, it is viewed as largely subjective and emotive process (Barnes et al., 2000).

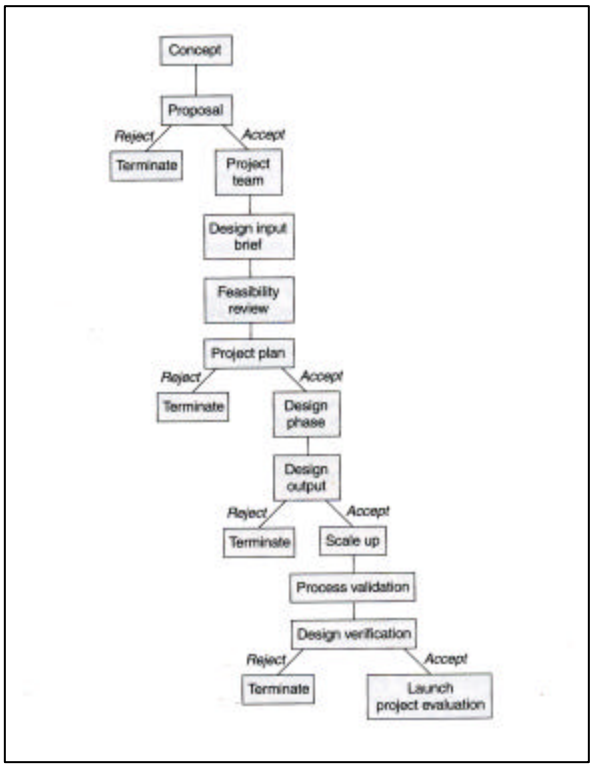


Figure 7. NPD Procedure Flow Chart at Bandage

Source: Bruce, M. & Cooper, R. (2000). *Creative Product Design.* New York: Wiley. p. 143.

4.5.2. Requirement Capture for Bandage

"Although there is a form of a phase review system in the NPD process at Bandage (Figure 7), in reality this system does not work" (Barnes et al., 2000, p. 150). In the idea generation stage, although anybody at Bandage can generate an idea for new products, there is no formalized way of establishing idea generation. Anybody who has an idea for a new product approaches an NPD manager, who will assess the idea informally (Barnes et al., 2000). Formalized idea generation techniques include brainstorming sessions, market needs established through market research, and technical focus meeting. However, there may be numerous ideas from these processes that never make it into a formal procedure (Barnes et al., 2000). Because of the fact that requirement capture is not recognized as a process in itself, there is no information gathering that is specific to this process at Bandage.

Any requirement capture activities at Bandage are informal, dependent on the project concerned, and carried out on an *ad hoc* basis. Although there have been many successful new products launched by Bandage, they have been designed primarily towards a short-term market. Barnes and Bruce (2000) point out, "In order to improve long-term growth through new product launches, reduce time to market, decrease cost of development and improve the chances of new products, they need to implement a tighter NPD process and develop a model of requirement capture" (P. 151).

4.6. Thorlo, Inc.

Thorlo, the initiator of the activity specific sock, is a family owned company that manufactures sock products for hiking, hunting, snow sports to tennis (Thorlo, 2005). For the past twenty-three years, the company has dedicated itself to understanding customer needs and designing comfortable and protectable sock products fit with its user benefits (Thorlo, 2005). Many customers today regard Thorlo socks, made by the North Carolina manufacturing specialist, as the "Rolls Royce" of the sector (McCurry, 2003). Section 4.6.1 illustrates how Thorlo wrote a success story in the sock market.

4.6.1. Opportunity Identification

Twenty-five years ago, Jim Throneburg, a chairman of Thorlo, Inc., was in his early 40s, overweight and having trouble with the exercise routine he had begun. He recognized that the problem was caused by his feet which hurt from miles of walking and jogging. He and a design engineer developed a new kind of extra-cushiony sock that had padding placed to absorb shock and prevent friction (Wireback, 2005, See Figure 8). This story shows the successful start of a new industry, the sport-specific sock. Throneburg (2005) states, "We take it to a level nobody else does. The rules of hosiery industry and the rules we play by are totally different" (Wireback, 2005, p. A1).

Throneburg's rules are related to the design and development of special products for every activity where comfort and performance are important. The merchandising campaign for these engineered socks reflects the matching of product features to the demands of the sport or other activities (Wireback, 2005).

Figure 8. Throlo Hiking Socks

Source: Campmore.com. (n.d.). Retrieved July 20, 2005, from http://www.campmor.com.

4.6.2. Product Benefits

Thorlo started out producing socks designed for running, golf and hiking. They now have expanded production of socks for five competitive sports, four outdoor pursuits, such as hunting, two snow sports, four phases of military life and three levels of civilian lifestyle (Wireback, 2005). They sell from $10.99 to $12.99 per pair. However, many customers have been willing to pay for it because the Thorlo sock offers numerous core benefits to the customers such as comfort, breathability, added protection against blistering and abrasion, firm fit and reinforced heel (Wireback, 2005). In practice, blister prevention and moisture control are common goals throughout the highly competitive outdoor sock supply chain (McCurry, 2003). Throneburg finds out what works not by asking researchers, but by staying in close contact with the customers who buy his product. He says that he only enters a market if he can design a sock with a combination of cushioning, wicking and other factors that the consumer considers benefits (Wireback, 2005). To achieve the core product benefits, the company has invested millions of dollars in medical and sports performance research (Thorlo, 2005).

4.7. Italian Sport Shoe Cluster

Although many companies individually undertake new product development, companies can group together to enhance competition. Montebelluna is located in Northeast in Italy and has the largest cluster of sport shoe companies in the world. This region is known for privately held small sport shoe companies, who are innovative in design and styling.

Ciappei and Christian (2005) researched main success factors engrained in the new product development practices of Italian sport shoe companies in the Montebelluna cluster. They surveyed 20 companies out of 420 companies located in the Montebelluna cluster in Italy. Mean annual sales for the surveyed companies were 28 million Euros and the mean number of company employees was 87.6 (Ciappei & Christian, 2005).

4.7.1. Proposition for New Product Success

First, they proposed that new product success of the companies located in Montebelluna depends upon the following four main areas:

(1) *Networking*: The development of relationships with external individuals or companies, both customers and suppliers, that a firm involves in product innovation;
(2) *Organization*: The way a company is organized for new product development (NPD) (i.e. NPD team, cross-functional integration vs functional approach, senior management support and commitment, characteristics of the team leader);
(3) *Information and communication technologies*: The use of advanced technologies (computer-aided and rapid prototyping technologies) to support and increase the effectiveness of the NPD process; and
(4) *Time-reducing efforts*: The set of initiatives a company undertakes to reduce the time-to-market (Ciappei & Christian, 2005, p. 23).

4.7.2. Major Success Factors for NPD

Based on the four main factors, Ciappei and Christian (2005) proposed 17 hypotheses and attained three major results that provide a positive influence on new product success in the sport shoe industry:

(1) *Team approach*: A systematic use of NPD teams is required, but not enough to differentiate between the top performers and the other companies. Although companies need to adopt a team approach for NPD to survive, it alone does not lead to success (Ciappei & Christian, 2005). However, in order to accomplish high levels of

new product success, the NPD team must not be simply multi-functional. The most effective NPD teams include representatives of many functions and also customers or lead users. According to PDMA, "Lead users are users for whom finding a solution to one of their consumer needs is so important that they have modified a current product or invented a new product to solve the need themselves because they have not found a supplier who can solve it for them" (PDMA, 2005). The NPD team must then be wide open to put together the valuable contribution of external sources of innovation and knowledge (Ciappei et al., 2005).

(2) *Customer Orientation*: The involvement of customers at diverse stages of new product development process encourages sport shoe manufacturers to directly bring in their preferences, limiting distortions and filtering effects related to market research and data analysis (Ciappei et al., 2005). In order to effectively enhance new product success, a company should integrate lead users into the process, as it contributes to the anticipation of requirements that will eventually be shared by the mass market, to more easily recognize the problems related to use of technical sport shoes, and to closely contact one of the main sources of product innovation (Ciappei et al., 2005).

(3) *Technology*: It is very critical for sport shoe manufacturers to use advanced information and communication technologies including computer-aided technologies because the technologies reduce costs and time for new product development (Ciappei et al., 2005).

Ciappei and Christian (2005) finally suggested, "Sports shoe (and other clothing and apparatus) manufacturers that want to improve their NPD capability should proactively develop close relationships with their customers, not just for pushing their sales, or for communicating their brand image, but most of all to better understand the customer needs, to absorb their knowledge and combine it with that of their employees, to be ready to catch early and weak signs of new sports, emerging needs and trends, and to monitor innovating ideas that lead users might be developing" (p. 36).

5. Future of New Product Development

Urban et al. (1993) have introduced the critical success factors that have characterized the new-product development changes in emphasis over time (Table 3).

	1970s	1980s	1990s
Critical Success Factors	Market and benefit segmentation Product proposition and perceptual mapping Stochastic forecasting model Creative group model Idea Screening	Portfolio theory Premarket forecasting and conjoint analysis Decision support systems and UPC scanner data Technology/marketing integration and lead users Competitive strategy and sustainable competitive advantage	Total quality Customer satisfaction Time to market Manufacturing integration with R&D and marketing Worldwide strategy and alliances

Table 3. Critical Success Factors for NPD

Source: Urban, G. L. & Hauser, J. R. (1993). *Design and Marketing of New Products* (2nd ed.). New Jersey: Prentice-Hall. p. 664.

According to Urban et al. (1993), in the future, the challenges will be greater as technology advances more quickly, global competition becomes fiercer, customer needs become more refined and subject to change, and as amazing social, political and organizational changes occur. New approaches and new techniques will be continuously developed and existing concepts will be incessantly improved. The environment also will be changing rapidly, so the firm must learn to effectively adapt and evolve to succeed under new challenges and new goals (Urban et al., 1993).

McGrath (2004) describes the next generation of new product development as the Research and Development (R&D) Productivity Generation. "Just as the Time-to-Market (TTM) Generation of the 1990's gave rise to strategies for time-based competition, the R&D Productivity Generation will give rise to development-productivity-based competition" (McGrath, 2004, p. 20).

Figure 9 depicts the four generations of product development management. According to McGrath (2004), in the R&D Productivity Generation, the new product development process will be transformed into a highly efficient, highly automated, and highly integrated enterprise-wide process that will operate at an extraordinary performance level. The next generation goes beyond the primary focus on project management of the previous generation to involve comprehensive resource management, an integrated portfolio, and product strategy; and introduce more management practices than the previous generation (McGrath, 2004). However, the next generation of productivity-based gains needs integrated systems to allow the new practices (McGrath, 2004).

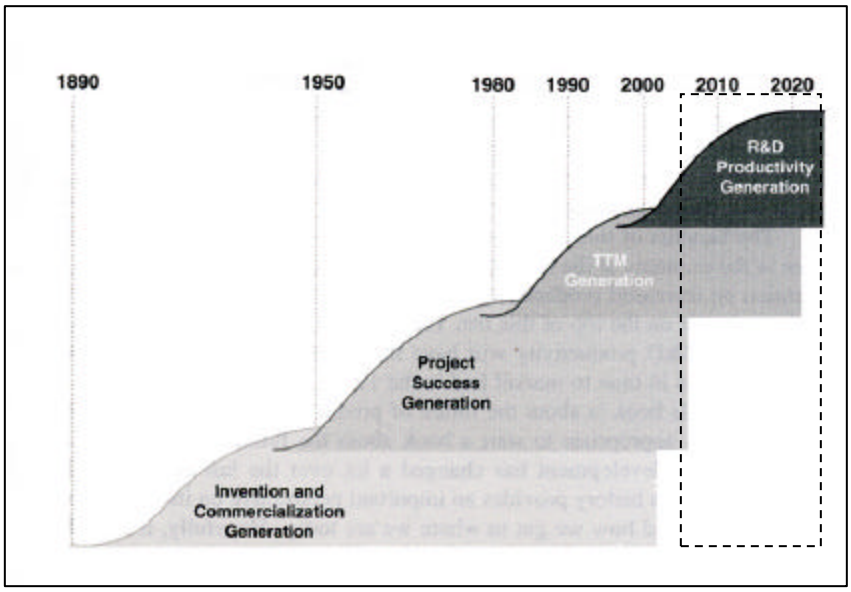


Figure 9. Four Generations of Product Development Management

Source: McGrath, M. E. (2004). *Newt Generation Product Development: How to Increase Productivity, Cut Cost and Reduce Cycle Times*. New York: McGraw-Hill. p. 4.

5.1. Future of NPD in Textile and Apparel Industry

Global competition in the textile and apparel industry has become more intense due, in part, to the changes in regulation of world trade. To compete and survive in the future of textiles and apparel, firms will need to be innovative in new product development, while reducing cycle times and cutting costs. Indeed, in a time competitive environment, companies will be most successful if their development times are shorter and if their products are generated faster than its competitors (Filippini, Salmaso, & Tessarolo, 2004). More textile and apparel companies have been forming strategic alliances in order to reduce the time and improve flexibility and responsiveness (Senanayake & Little, 2001). These strategic alliances also relate to the effectiveness of innovation strategies (Faems, Looy, & Debackere, 2005). American Fibers and Yarns Company, for example, have had the strategic alliances with their suppliers to develop innovative technology for the product lines and join suppliers to help them bring new technologies to market (Rodie, 2004).

Another issue is the development of innovative technology and the effective adoption of technical changes to be competitive in the global textile and apparel industry. The product development structure has been improved through the adoption of integrated computer systems, where all functions are capable of being accessed and using all data on a real time basis (Senanayake & Little, 2001). The new technology and technical advances will enable retailers and consumers to take a proactive role in the product development process. Additionally, the improved technologies including CAD/CAM technologies are expected to allow faster response to the customers' requirements at a lower cost.

Governments are taking an active role in supporting new product development initiatives. For examples, the government of Hong Kong has challenged its industries to implement innovative product development efforts with the following foci:

1) materials technology to produce innovative and novel fibers, fabrics, and related product treatment and

finishing processes such as nano-technology;
2) product design including feature design and functional design for the textile, clothing and footwear industry; and
3) prototyping technology to produce samples in a quick and responsive manner with the use of CAD/CAM technology and advanced manufacturing system (Hong Kong Government, 2001).

In future markets, the growth potential for textiles as components in composite materials is increasing. The use of technical textiles such as three dimensional construction, nano-technology, and electronic integration, is expected to bring high added value to product application in apparel, medical, automotive, and other markets.

To strengthen competitiveness in the global textile and apparel industry, new product development has become a key strategy. Yet this strategy requires a detailed process, which takes into account market, design, technology, and finance.

6. References

American Fibers and Yarns Co. (n.d.). Retrieved June 24, 2005, from http://www.afyarns.com.

Apperson, M. (February 12, 2004). Interviewed at headquarter of American Fibers and Yarns Company in Chapel Hill, NC.

Astebro, T. & Michela, J. L. (2005). Predictors of the Survival of Innovations. *Journal of Product Innovation Management*. 22. p. 322-335.

Barclay, I., Holroyd, P. & Poolton, J. (1995). The New Product Development Process: A Sphenomorphic Management Model. *International Journal of Vehicle Design*: *The Journal of the International Association for Vehicle Design.* 16(4/5). p. 365-374.

Bayus, B. L., (1997). Speed-to-Market and New Product Performance Trade-offs. *Journal of Product Innovation Management*. 14. p. 485-497.

Belliveau, P, Griffin, A & Somermeyer, S. (2002). *The PDMA Toolbook for New Product Development*. New York: Product Development & Management Association.

Bitz, K. (2nd Quarter, 2004). The World Nonwovens Industry: Part 1- The Leading Ten Producers. *Technical Textile Markets.* Issue 57. p. 31-41.

Borneman, J. M. (June, 2005). Glen Raven – Market-Driven To the Core. *Textile World*. 155(6). p. 20.

Borneman, J. M. (June, 2005). Letting Markets Lead the Way. Retrieved June 22, 2005, from http://www.textileworld.com

Borneman, J. M. (June, 2005). Recognizing the Power of the Resilience. Retrieved June 22, 2005, from http://www.textileworld.com.

Brentani, U. (2001). Innovative versus Incremental New Business Services: Different Keys for Achieving Success. *Journal of Product Innovation Management*. 18. p. 169-187.

Bruce, M. & Biemans, W. G. (1995). *Product Development – Meeting the Challenge of the Design-Marketing Interface*. New York: John Willey & Sons. p. 13, p. 16, p. 17, p. 84-86.

Bruce, M. & Cooper, R. (2000). *Creative Product Design*. New York: Wiley. p. 133-155.

Cagan, J & Vogel, C. M. (2002). *Creating Breakthrough Products – Innovation from Product Planning to Program Approval*. New Jersey: Prentice Hall. p. 7-8, p. 242-248.

Campmore.com. (n.d.). Retrieved July 20, 2005, from http://www.campmor.com.

Carrillo, J. E. & Franza, R. M. (2004). Investing in Product Development and Production Capabilities: The Crucial Linkage between Time-to-Market and Ramp-up Time. European Journal of Operational Research. Retrieved July 9, 2005, from http://www.sciencedirect.com.

Ciappei, C. & Simoni, C (2005). Drivers of New Product Success in the Italian Sports Shoe Cluster of Montebelluna. *Journal of Fashion Marketing and Management*. 9(1). p. 20-42.

Cole, M. (December, 2003). High-Tech Performance Fabrics Give Aeron Chair A Leg Up. *International Fiber Journal*. 18(6). p. 14-15.

Cooper, R. G. & Kleinschmidt, E. J. (1986). An Investigation into the New Product Process: Steps, Deficiencies, and Impact. *Journal of Product Innovation Management*. 3(2). p. 77-85.

Cooper, R. G. & Kleinschmidt, E. J. (1994). Determinants of Timeliness in Product Development. *Journal of Product innovation Management*. 11. p. 381-396.

Cooper, R. G. (1999). From Experience: The Invisible Success Factors in Product Innovation. *Journal of Product Innovation Management*. 16. p. 115-133.

Cooper R. G. (2001). *Winning at New Products* (3rd ed.). New York: Addison-Wesley. p. 8, p. 14-15, p. 130-141.

Cormican, K. & O'Sullivan, D. (2004). Auditing Best Practice for Effective Product Innovation Management. *Technovation*. 24. p. 819-829.

Crawford, M. & Benedetto, A. D. (2003). *New Products Management* (7th ed.). New York: McGraw-Hill. p. 5, p. 8, p. 11-13, p. 24, p. 27, p. 29-31, p. 210, p. 271.

De Brentani, U. (2001). Innovative versus Incremental New Business Services: Different Keys for Achieving Success. *Journal of Product Innovation Management*. 18. p. 169-187.

Deeds D. L. & Rothaermel, F. T. (2003). Honeymoons and Liabilities: The relationship between Age and Performance in Research and Development Alliances. *Journal of Product Innovation Management*. 20. p. 468-484.

Erhorn, C. & Stark, J. (1994). *Competing by Design: Creating Value and Market Advantage in New Product Development*, Vermont: Essex Junction.

Faems, D., Looy, B. V., & Debackere, K. (2005). Interorganizational Collaboration and Innovation: Toward a Portfolio Approach. *Journal of Product Innovation Management*. 22.
p. 238-250.

Filippini, R., Salmaso, L., & Tessarolo, P. (2004). Product Development Time Performance: Investing the Effect of Interactions between Drivers. *Journal of Product Innovation Management*. 21. p. 199-214.

Frambach, R. T., Prabhu, J. & Verhallen, T. M. M. (2003). The Influence of Business Strategy on New Product Activity: The Role of Market Orientation. *International Journal of Research in Marketing.* 20. p. 377-397.

Freudenberg Nonwovens. (n.d.). Retrieved July 24, 2005, from http://www.nonwovens-group.com.

Glen Raven Inc. (n.d.). Retrieved June 22, 2005, from http://www.gleraven.com.

Gross, D. (Spring, 2005). Yarn Specialist Targets Knits. *Knit Americas.* p. 58.

Gruenwald, G. (1992). New Product Development (2nd ed.). NTC Business Books. Illinois: Lincolnwood.

Hart, S. & Baker, M. (1994). The Multiple Convergent Processing Model of New Product Development. *International Marketing Review*. 11(1). p. 77-92.

Herman Miller Inc. (n.d.). Retrieved June 27, 2005, from http://www.hermanmiller.com.

Hoechst Celanese. (1990). *Dictionary of Fiber & Textile Technology.* North Carolina: Hoechst Celanese. p. 3.

Hong Kong Government. (2001). Innovative and Technology Fund (ITF) Project Solicitation. Retrieved July 15, 2005, from http://www.itf.gov.hk.

Himmelfarb, P. (1992). *Survival of the First: New Product Development in the 90's.* New Jersey: Prentice Hall.

Keiser, S. J. & Garner, M. B. (2003). *Beyond Design - The Synergy of Apparel Product Development*. New York: Fairchild Publication Inc. p. 76.

Kotler, P. (1980). *Principles of Marketing*. New Jersey: Prentice Hall.

Kotler, P. (1997). *Marketing Management – Analysis, Planning, Implementation, and Control* (9th ed.). New Jersey: Prentice Hall.

Kumar, S. & Phrommathed, P. (2005). *New Product Development – An Empirical Study of the Effects of Innovation Strategy, Organization Learning, and Market Conditions*. New York: Springer. p. 55-57.

Langerak, F., Hultink, E. J. & Robben, H. S. J. (2004). The Impact of Market Orientation, Product Advantage, and Launch Proficiency on New Product Performance and Organizational Performance. *Journal of Product Innovation Management*. 21. p. 79-94.

May-Plumlee, T. A. (1999). *Modeling Apparel Product Development Using Consumer Purchase Criteria.* A dissertation submitted to North Carolina State University. Raleigh.

McCurry, J. W. (Fall, 2003). Take a Hike in Comfort. *Knit Americas*. p. 51-53.

McCurry, J. W. (May, 2004). Glen Raven's History Proves the Power of Metamorphosis. *Technical Textiles International*. 13(3). p. 9.

McDermott, C. M. & O'Connor, G. C. (2002). Managing Radical Innovation: An Overview of Emergent Strategy Issues. *Journal of Product Innovation Management*. 19. p. 424-438.

McGrath, M. E. (2004). *Newt Generation Product Development: How to Increase Productivity, Cut Cost and Reduce Cycle Times*. New York: McGraw-Hill. p. 3-22.

Monczka, R. M. et al. (2000). *New Product Development – Strategies for Supplier Integration*. Wisconsin: American Society for Quality. p. 5.

Nakamura, M. (2005). Joint Venture Instability, Learning and the Relative Bargaining Power of the Parent Firms. *International Business Review*. 14. p. 465-493.

Naver, J. C., Slater, S. F. and MacLachlan, D. (2000). Total Market Orientation, Business Performance and Innovation. *Marketing Science Institute*. Working Paper Series, Report No. 00-116.

Nonwovens Industry. (September, 2003). Freudenberg & Co. 34(9). p. 38-42.

Nonwovens Industry. (September, 2004). Freudenberg Nonwovens. 35(9). p. 36-40.

PDMA (n.d.). Retrieved June 26, 2005, from http://www.pdma.org.

Plunkett Research, Ltd. (n.d.). Retrieved June 30, 2005, from http://www.plunkettresearch.com.

Rivas, K. (June 19, 2005). For Glen Raven Inc., It's All in the Family. *Times-News*. p. A1.

Rodie, J. B. (November, 2004). From Fiber to Market. *Textile World*. 154(11). p. 22.

Rosenthal, S. (1992). *Effective Product Design and Development: How to Cut and Lead Time and Increase Customer Satisfaction*. Illinois: Homewood.

Rothwell, R. & Gardiner, P. (1984). Design and Competition in Engineering, *Long Range Planni*ng. 17(3). p. 78-91.

Sanchez, A. M. & Perez, M. P. (2003). Cooperation and Ability to Minimize the Time and Cost of New Product Development within Automotive Supplier Industry. *Journal of Product Innovation Management*. 20. p. 57-69.

Saren, M. (1994).Reframing the Process of New Product Development: From a "Stages" Model to a "Blocks" Framework. Journal of Marketing Management. 10(7). p. 633-643.

Senanayakw, M. M. & Little, T. J. (Spring, 2000). "Measures" for New Product Development. *Journal of Textile and Apparel, Technology and Management*. 1(3).

Skerlj, T. & Prasnikar, T. (2005). New Product Development Process and Time-to-Market in the Generic Pharmaceutical Industry. *Industrial Marketing Management*. p. 1-13.

Smith, P. G. (1999). From Experience: Reaping Benefit from Speed to Market. *Journal of Product Innovation Management*. 16. p. 222-230.

Sun, H. & Wing, W. C. (2005). Critical Success Factors for New Product Development in the Hong Kong Toy Industry. *Technovation*. 25. p. 293-303.

Textile World. (2005). Retrieved June 27, 2005, from http://www.textileworld.com.

Thorlo. (June 6, 2005). Making a Greener Sock - Thorlos® Practices Earth-friendly Manufacturing. Retrieved July 19, 2005, from http://www.thorlo.com.

Thorlo. (n.d.). Retrieved July 19, 2005, from http://www.thorlo.com.

Trott, P. (2002). *Innovation Management and New Product Development* (2nd ed.). London: FT Prentice Hall. p. 212.

Tyler, B. B. & Gnyawali, D. R. (2002). Mapping Managers' Market Orientations regarding New Product Success. *Journal of Product Innovation Management*. 19. p. 259-276.

Ulrich, K. T. & Eppinger, S. D. (2004). *Product Design and Development* (3rd ed.). New York: McGraw-Hill. p. 3, p. 12-15, p. 50, p. 120, p. 184.

Urban, G. L. & Hauser, J. R. (1993). *Design and Marketing of New Products* (2nd ed.). New Jersey: Prentice-Hall. p. 3-6, p. 14, p. 33-34, p. 38-39, p. 55-56, p. 164-167, p. 447, p. 597.

Van Riel, A.C. R., Lemmink, J. & Ouwersloot, H. (2004). High Technology Service Innovation Success: A Decision-Making Perspective. *Journal of Product Innovation Management*. 21.
p. 348-359.

Wireback, T. (July 18, 2005). Socking It to Import; Thorlo's Niche-Market Approach Makes Big Tracks in U.S. Textiles. *News & Record* (GreensBoro, NC). p. A1, p. A6.

Wren, B. M., Souder, W. E. & Berkowitz, D. (2000). Market Orientation and New Product Development in Global Industrial Firms. *Industrial Marketing Management*. 29. p. 601-611.