AN EXPLORATORY CASE STUDY: KNOWLEDGE CREATION AND CONVERSION WITHIN A SMALL APPAREL MANUFACTURER

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Abstract

There is nothing better than a consumer being excited as they see new products in the retail stores. Yet, when new products did not arrive on a regular basis, the excitement subsided and consumers went elsewhere. In order to meet the growing demands, apparel companies increased the frequency at which products were developed. Hence, creating a continual cycle in the development of products occurred at the companies. The purpose of this qualitative case study was to explore knowledge creation and conversion within an apparel company as it developed a product line for market. Knowledge is best explored within a contextual setting. With that in mind, this study was set into the product development department at a small apparel manufacturer. Six out of the seven members in the department chose to participate in the study’s interviews and observations. The analysis of the findings led to the emergence of three themes being (1) artifacts of the new product development (NPD), (2) knowledge intensive activities, and (3) passive knowledge sharing. These themes loop back into the study’s question of how is knowledge created and converted during product development. In new product development (NPD), explicit knowledge exists in such artifacts as technical packets (tech packs, product samples and fabric binders. As a product is developed it progresses through various knowledge intensive activities that created, converted and shared knowledge. For products to advance toward production knowledge sharing needs to occur among those involved in the development process. The conclusion for this study was that knowledge creation, conversion, and sharing are intertwined as an apparel product was developed for market.

Keywords: knowledge creation, knowledge conversion, new product development (NPD), fashion industry
Dedication

This dissertation is dedicated to my former mentor and master teacher—Mrs. Ellen Stookey.

I sat nervously before you many years ago as you advised and prepared me to enter the teaching program at Poly. I was placed at ease by your welcoming smile and easy demeanor. By the end of our advising session, you had determined who I was as an individual and predicted the type of educator I would be in the future. You believed I had great potential and it was just waiting to emerge.

However, the emergence of this untapped potential would only occur through the challenges that lay before me. You said I would encounter challenges as that was just who I was as an individual, and I would never shy away from them. You told me to view these challenges as a means of polishing a facet on a gem. For it is when each facet is polished, the brilliance of the gem shines through.

Mrs. Stookey, I have strived to achieve the future you envisioned for me so many years ago. With each challenge that was encountered, whether good or bad has polished many facets over the years. It is my hope that this latest challenge has brought additional shine to the gem and my potential continues to emerge. I just wish you were here to share in the latest challenge.
Acknowledgements

To say that this journey to completion did not have its challenges to overcome would be an understatement. Yet to acknowledge those only at this point of the journey is not enough as other individuals inspired and supported me through my entire academic endeavors. There are those individuals that contribute to your result, whether at a professional or on a personal level. Professionally speaking as an educator, my path was forged in high school by some remarkable teachers. To them, I acknowledge that you put me on the path to becoming a teacher. It was your enjoyment in educating the next generation that sparked my desire to teach.

Nevertheless, desire is not enough; it takes knowledge and an educational background to achieve such a goal. I was allowed to gain that knowledge and background during my studies at Cal Poly – SLO, whose “learn by doing” I still emulate to this very day. I walked away with a “hidden” set of skills that of a confidence for facing challenges head on. My professors primed this by their mantra of “There are no limits to your degree, except those that you place on it.”

I would also like to acknowledge those individuals who took the risk on hiring me for various positions, whether it was at the educational or professional level. You allowed me to stretch past my established boundaries, something I hope I have shared with my own students. It is stretching past those boundaries that have allowed me to achieve this amazing and unbelievable accomplishment. However, that is another story for another time.

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reader. To Carol Sharicz for introducing me to Nonaka’s (1994) knowledge creation theory—thank you so much.

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Chapter 1: Introduction

To an outsider, the apparel industry appears to function in a chaotic and erratic manner at best (Dyer & Ha-Brookshire, 2008). Small apparel companies face challenges in the market as they fight for consumer dollars with the larger companies (Forney, Rosen, & Orzechowski, 1990). Some small companies are challenged by their order sizes, which have the tendency to run small in quantity. Small orders also mean small production runs, which are harder to place with factories. Factories desire larger orders as they make a higher profit level and maintain a constant flow of work on the production floor (Forney et al., 1990).

These small companies are met with challenges as they try to purchase fabric (Forney et al., 1990). Small orders use smaller amounts of fabric, thus companies do not meet the minimum yardage order required by the mills. Since minimums are out of their range, small companies acquire fabric through jobbers or overruns at the mills (Forney et al., 1990). Those that do survive do so by aggressively competing with the larger companies. These small companies show high levels of creative innovation and flexibility as they compete in a niche market (Ha-Brookshire, 2009). The entrepreneurial spirit and drive are known to contribute to the success of these small apparel companies (Dyer & Ha-Brookshire, 2008; Ha-Brookshire, 2009). Success is dependent on the individuals employed by those companies and the knowledge and years of experience they bring (Dyer & Ha-Brookshire, 2008; Ha-Brookshire, 2009).

Statement of the Problem

Companies need a competitive edge in the marketplace if they are to have any intent of survival (Brown & Eisenhardt, 1995; Khan, Christopher & Creazza, 2011). This edge is achieved by having employees with critical skills and knowledge of the industry and its various
consumer markets (Kim, 2013). The introduction of new products into the marketplace is dependent on accessing these features (Lin & Piercy, 2013).

There is logic to the disharmony that exists between the calendars used for apparel planning versus a yearly calendar (Rosenau & Wilson, 2014; Senanayake & Little, 2001). It is not common for industries to produce winter products during the summer months or summer products during the winter. Yet, for those back-to-school items to be in the retailers at the beginning of August, development needs to occur at least six months prior (Senanayake & Little, 2001). Orders are taken six months before the products are due in the store, thus allowing four months to manufacture and ship the completed products (Bruce & Daley, 2006). There is always a last-minute fitting session that occurs prior to the start of production. Fabric cannot be cut without fitting and quality issues must resolved prior to production; otherwise, the company risks the return of products and damage to their brand (Senanayake & Little, 2001). While disharmony reigned on the calendar, it is the new products every few weeks in the stores that have the consumers repeatedly returning (Bandinelli, Rinaldi, Rossi & Terzi, 2013; d’Avolio, Bandinelli & Rinaldi, 2015).

Apparel companies need to conduct research if they want to create a continual flow of new products to attract consumers (Bandinelli et al., 2013). Research is conducted in the areas of consumer base, marketing position, and product trends. This research provides information and knowledge that is used to create new products for market (Bandinelli, et al., 2013). How the knowledge and information are utilized for new products depends on the experience and knowledge of those within the company (Lin & Piercy, 2013). Fast fashion retailers as H&M and Zara produce new products within a matter of weeks instead of months (Bhardwaj &
For such consistent development, product knowledge must be shared and transferred between individuals (Bandinelli, et al., 2013).

Research is scant regarding how apparel companies create and manage their knowledge as they develop and bring products to market. Past researchers have delved into the efficiency of the supply chain and its ability to deliver a product to market (Danskin, Englis, Solomon, Goldsmith, & Davey, 2005). Researchers have also examined the logistics and coordination of the supply chain as the product is moved into retail stores (Simatupang, Wright, & Sridharan, 2000). While supply chain research does exist, it is limited in the area of product development, according to Lin and Piercy (2013). Existing research is somewhat limited when it pertains to the role of knowledge and its usage in product development. Therefore, this paper explores knowledge and its role within the development of apparel products.

**Significance of the Problem**

The days of a product-driven apparel industry, where production was based on a company’s perception of consumer needs, are ended (Khan et al., 2011). Now, it is consumer-driven, thus causing fresh new products to arrive at retail stores every few weeks (Bhardwaj & Fairhurst, 2010). Getting those products into the stores in the shortest time possible is called *fast fashion*, and the industry leader is Zara (Bruce & Daly, 2006). For fast fashion to work, times were shortened in the development, production, and shipment of products. Yet, not every company expanded their seasons or shortened product development times for the same reasons. Some companies operated on fewer seasons, and were still equally responsive to consumer demands (Lee, Tse, Ho, & Choy, 2015). The purpose for this was to close the gap between the demand of the consumer and the product’s reaching the retailers (Bhardwaj & Fairhurst, 2010).
Prior to the 90s, the fashion calendar and its seasons of spring/summer and fall/winter were based on the dates of trade and fashion shows (Bhardwaj & Fairhurst, 2010). With fewer seasons, there was less need for the industry to develop new products. However, the number of seasons grew as the industry moved toward being consumer-driven. Apparel companies moved from four to five, with one brand moving to six seasons per year (Bhardwaj & Fairhurst, 2010; Sen, 2008). As the seasons expanded, time decreased for development, production, and shipping (Lee et al., 2015). Each company felt the pressure from this shortened time frame as they attempted to get more products out to the consumer (d’Avolio et al., 2015).

The pressure caused companies to overlap their developmental phases in order to ship to retailers. The overlaps create a continual flow in the development of products. Within this continuous flow are multiple seasons that must be juggled at the same time (Bandinelli et al., 2013; d’Avolio et al., 2015). Within the multiple seasons, a variety of products exist at different stages that range from conceptual to being production-ready. Knowledge-intensive activities are used to advance the products through the developmental stages (d’Avolio et al., 2015). At each stage and with each activity, knowledge is created, shared, and retrieved (Bandinelli et al., 2013).

Research Question

The overall question that guided this exploratory research was the following: How does a small U.S. apparel company engage in knowledge creation and conversion processes as it develops a product line for market? Therefore, the purpose of the research was to explore knowledge creation and conversion within an apparel company as it developed a product line for market.

Theoretical Framework

Research has suggested that knowledge is more than mere information. For that
transformation to happen, knowledge must be placed into some type of context (Nonaka, Toyama, & Konno, 2000). With context in place, knowledge becomes dynamic as individuals interact with each other (Nonaka & Konno, 1998). These concepts are based on the Japanese philosophy of a justified true belief (Nonaka, 1994). These concepts, along with knowledge types, are embedded within knowledge creation (Nonaka, 1994).

The theory of organizational knowledge creation is viewed as an approach to the creation of knowledge and the processes that knowledge undergoes as it is converted (Nonaka, 1994). Nonaka (1994) argues that knowledge is more than just information; it is a personal belief. Knowledge is said to be created from the flow of information and is organized by the individual. Nonaka (1994) discusses knowledge as being composed of two elements, not one (as stated by other organizational learning theorists). These elements of knowledge are tacit and explicit (Nonaka, 1994). Tacit knowledge is defined as knowledge which resides within an individual. Since this type of knowledge is only within an individual, it is harder to express to others. Although it is hard to express, it can be shared through learn-by-doing or on-the-job training. The second element, known as explicit knowledge, is easier to express and share with others (Nonaka, 1994). This type of knowledge is shared through such items as manuals, documents, and procedures.

**Assumptions.** The theory of organizational knowledge creation defines knowledge, the movement and creation of knowledge, and the modes of knowledge conversion (Nonaka, 1994). Its first assumption is that knowledge is a personal and justified belief. Knowledge can be defined at the personal level as it is said to reside within an individual. Since knowledge resides within the individual, then the individual moves the knowledge within the company. This leads to the second assumption, the movement of knowledge (Nonaka, 1994). The four modes of
knowledge creation (SECI) are the bases for the theory’s third assumption (Nonaka, 1994).

These modes are used to explain the continuous dialogue that occurs between the two types of knowledge through the creation and conversion processes.

**SECI—knowledge conversion processes.** The socialization mode is the starting point for tacit to tacit conversion (Nonaka, 1994) (see Figure 1).

![Diagram of knowledge modes]


This mode is where tacit knowledge is shared between individuals and is also converted into new tacit knowledge by a social experience (Nonaka, 1994). A social experience is explained as the interaction between apprentices and their mentors. As this mode is concerned with tacit knowledge which is hard to express, the conversion context is a learn-by-doing situation (Nonaka, 1994).

The next mode in the conversion process is *combination,* according to Nonaka (1994). This mode is the sharing of explicit knowledge between individuals. It occurs within a social context such as meetings, where explicit-to-explicit knowledge is shared and combined. As the
knowledge is shared, it is combined with existing knowledge in the creation of new explicit knowledge.

The final two modes in the conversion processes involve both tacit and explicit knowledge (Nonaka, 1994). When knowledge is converted from tacit to explicit, it is being processed in the externalization mode. In this mode, tacit knowledge is expressed and converted into explicit knowledge. The last mode, known as internalization, involves the conversion of explicit to tacit knowledge (Nonaka, 1994). The last mode gives the appearance of knowledge coming full circle, as explicit converts to tacit and resides within the individual.

The spiral motion. Although each knowledge type is capable of creating knowledge separately, the process works best in unison. The central focus of knowledge creation is the interaction between the two knowledge types (Nonaka, 1994). These interactions cause knowledge to move through the various conversion processes in an upward spiral (Nonaka, 1994). It is this motion that perpetuates the continuous dialogue between the two knowledge types. The spiral motion not only assists with the continuous dialogue, but also amplifies the creation of knowledge (Nonaka et al., 2000). The knowledge processes of SECI act as triggers for creation of new knowledge as it moves through the levels of the company (Nonaka et al., 2000).

Introduction of ba

The introduction of ba, a place where knowledge is shared through emerging relationship, builds on the original knowledge-creation theory (Nonaka & Konno, 1998). In Japanese, ba means space; thus Nonaka and Konno (1998) use ba to describe the place where knowledge is context. Ba provides a framework, which allows for the emergence of knowledge through the interactions of individuals or groups. Within this space, knowledge is embedded and
acquired through personal or group experiences (Nonaka & Konno, 1998). Just as knowledge exists at the various levels within an organization, so does \textit{ba} (Nonaka & Konno, 1998). \textit{Ba} is further explored and defined within a unified model of knowledge creation (Nonaka et al., 2000).

\textbf{The Unification}

Treating the organization as an entity allows a continuous flow of knowledge creation (Nonaka et al., 2000). When approaching knowledge creation from this perspective, a new model is needed. Nonaka et al. (2000) merges the knowledge elements of the SECI process, \textit{ba}, and knowledge assets into the knowledge-creating process model. The new model supports and provides an understanding of the dynamic creation of knowledge within an organization (Nonaka et al., 2000).

\textit{Ba}. With the merging of elements, Nonaka et al. (2000) further divides \textit{ba} into four modes that correspond to the SECI modes (see Figure 2 below).

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{ba_modes.png}
\end{figure}
The key concept of ba is the interactions of individuals or groups within a space (Nonaka et al., 2000). These interactions occur within each mode, whether they are face-to-face or virtual (Nonaka et al., 2000). The first mode is originating ba, which corresponds to the socialization mode in the knowledge-creating process (Nonaka et al., 2000). This mode deals with individual and face-to-face interactions as emotions, and the physical senses that are used in the sharing of tacit knowledge (Nonaka et al., 2000).

The dialoguing ba is the collective interactions of individuals as they share their knowledge (Nonaka et al., 2000). This mode provides context for the combination mode of knowledge creation, in which explicit knowledge is converted into new explicit knowledge (Nonaka et al., 2000). The systemizing ba allows the embodied explicit knowledge of an individual to be shared through various documents (Nonaka et al., 2000). This mode provides the space for the occurrence of externalization (Nonaka et al., 2000). The exercising ba provides context to explicit knowledge, so it can be embodied as tacit knowledge (Nonaka et al., 2000). This final mode of ba corresponds to the internalization of tacit knowledge by an individual (Nonaka et al., 2000).

**Knowledge assets.** The final element in the new model is knowledge assets (Nonaka et al., 2000) (see Figure 3 below).

<table>
<thead>
<tr>
<th>Experiential Knowledge Assets</th>
<th>Conceptual Knowledge Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine Knowledge Assets</td>
<td>Systemic Knowledge Assets</td>
</tr>
</tbody>
</table>

Knowledge assets are defined in this model as resources that contribute value to the firm. Within the knowledge-creating process, these assets are the inputs, outputs, and moderating factors (Nonaka et al., 2000). As this is the third element within the knowledge-creating process, it aligns and corresponds with each of the four modes of knowledge creation and *ba* (Nonaka et al., 2000). An *experiential* knowledge asset refers to the tacit knowledge within the firm. This tacit knowledge is built from the tacit experiences shared among individuals (Nonaka et al., 2000). While these assets involve tacit knowledge, they run parallel to the modes of socialization in originating *ba* (Nonaka et al., 2000). They are accumulated through the firm’s own experiences with knowledge (Nonaka et al., 2000). These types of assets are hard to duplicate or imitate, thus they provide value to the firm’s competitive advantage (Nonaka et al., 2000).

The other two knowledge assets are *conceptual* and *routine* assets (Nonaka et al., 2000). *Conceptual* knowledge assets are tangible, as they involve explicit knowledge, which is easier to understand (Nonaka et al., 2000). These contribute to the brand equity of the firm, through the incorporation of symbols and images (Nonaka et al., 2000). These assets parallel and correspond to the modes of externalization and dialoguing *ba* (Nonaka et al., 2000). Systemic knowledge assets are explicit knowledge in the form of documents and specifications (Nonaka et al., 2000). These assets lend themselves to the conversion of explicit knowledge to tacit knowledge, and they align themselves with the modes of systemizing *ba* and internalization (Nonaka et al., 2000). They are easily transferred, which means it is in the best interest of the firm to protect and treat them as proprietary (Nonaka et al., 2000). A *routine* knowledge asset is tacit knowledge when it is embedded within the daily routines of the firm (Nonaka et al., 2000). The firm builds on these routine assets through experience and practice (Nonaka et al., 2000). The corresponding modes
for this type of asset are combination and exercising \textit{ba} (Nonaka et al., 2000). The following illustration is a reflection of the combined elements of knowledge modes, interaction modes of \textit{ba} and corresponding knowledge assets (Figure 4).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{Illustration of SECI modes and the corresponding \textit{ba} modes and knowledge assets.}
\end{figure}


\textbf{The Controversies}

The theory is inadequate in some areas according to certain theorists (Nonaka & von Krogh, 2009). Hildreth and Kimble (2002) mention that Nonaka’s (1994) theory fails in the area of tacit to explicit knowledge conversion. The weakness lies within the definition of tacit knowledge itself (Hildreth & Kimble, 2002). They question how something that is hard to express can be converted into something that can be easily expressed (Hildreth & Kimble, 2002).
They state that tacit knowledge depends on the situation with only a portion of it being converted into explicit knowledge (Hildreth & Kimble, 2002).

Some theorists argue that the theory cannot be applied to Western organizations (Gourlay & Nurse, 2005). Gourlay and Nurse (2005) note that Nonaka (1994) treats tacit and explicit knowledge as being separable. They mentioned that other theorists state that tacit knowledge is needed in order to understand explicit knowledge (Gourlay & Nurse, 2005). Eastern philosophy, with the use of *ba*, works in Japanese management practices but does not have a place in Western thought (Glisby & Holden, 2003). Therefore, it would not be accepted by a Western organization (Glisby & Holden, 2003).

**Summary**

Over the years, the apparel industry has moved from being product-driven to trying to meet the demands of the consumer (Khan et al, 2011). Nevertheless, the times changed and the industry is now consumer-driven. Consumers desire to see new products in the retailers on a more frequent basis. For this to happen companies expanded their seasons and increased the number of products developed within each season (Bhardwaj & Fairhurst, 2010). The added pressure has companies offering more products per season, all within a shortened length of time. These changes cause a continual flow in the development of products, as the seasons overlap each other in a staggered pattern (Bandinelli, et al., 2013; Senanayake & Little, 2001). The development of new products is used to meet consumer demands, but also to stay competitive in the market (Senanayake & Little, 2001). This means that companies need to have personnel that were knowledgeable and experienced in the area of product development (Lin & Piercy, 2013). Their knowledge is shared with each other and contributes to the product as it progresses through
development. The intensive activities within product development allow knowledge to be created, shared, and retrieved (Bandinelli et al., 2013; d’Avolio et al., 2015).

**Key Terms and Definitions**

Knowledge:

*Ba*—A space where the knowledge is shared and exchanged through the interactions of individuals. The origin of the word is Japanese (Nonaka, 1994).

Explicit knowledge—A type of knowledge that is easily expressed (Nonaka, 1994).

Tacit knowledge—A type of knowledge that is hard to express (Nonaka, 1994).

SECI—The four modes of the knowledge conversion processes. Each letter represents a designated process: S = Socialization, E = Externalization, C = Combination and I = Internalization (Nonaka, 1994).

Apparel:

Merchandising (calendars)—This is a listing of major milestones and their deadlines needed bring a line to completion. The length of time represented in the calendar is based on the frequency of the company’s markets (Kincade & Gibson, 2010).

Time Action (calendars)—This is a listing of the necessary tasks needed to complete each product in the line. It reflects the deadline for each task and the individual responsible for completing the task. The department that is utilizing the planning tool determines what types of activities are to be included on the calendar (Rosenau & Wilson, 2014).

Concept/inspiration/mood boards—A collection of images that is used by a designer or product developer to visually express a feeling, mood or target consumer. These boards can be generated from magazine clippings, fabric swatches; color chips and trims samples, which are physically attached to the boards (Kincade & Gibson, 2010; Rosenau & Wilson, 2014).
Lab dip/swatch—A piece of fabric that was dipped in a prepared dye in an effort to achieve a desired stated color (Burns, Mullet, & Bryant, 2011).

Light box—Light boxes are utilized for the color matching of fabric or trim swatches. The box can be set at various lighting situations that are predetermined by the responsible individual. This allows the individual to view the submitted sample under the same lighting conditions as the vendor (Keiser & Garner, 2012).

Line sheets—A document that contains images of all the products being offered in the line. Also included on the document is product information such as style number, price, and colors. The product image is a computer rendered illustration (Kincade & Gibson, 2010).

Knit fabric—Knits refer to the interlooping of yarns (Kadolph, 2011).

Product development—This refers to the steps that move a product from its initial concept to an approved sample for production (Gaskill, 1992; Kincade & Gibson, 2010).

Prototypes/firsts—The first physical sample made of the product. Sample is constructed from an image of the product that was created through a computer rendering or sketch (Kincade & Gibson, 2010; Wickett, Gaskill, Damhorst, 1999).

Salesman/duplicates samples—Samples from the entire line are constructed and given to sales representatives. These samples are used to show the line at market and to buyers (Burns, et al., 2011).

Size set or size run—These samples are constructed to check the product prior to production. A sample is made in each size of the product. The samples are checked for fit, overall appearance and construction quality. It is also a way of checking the grade rules of the production pattern, a visual check on the proportions of the product (Lee & Steen, 2010).
Supply chain—The apparel supply chain starts with the raw materials, then fabric to products, then to retailer, and finally the consumers (Kincade & Gibson, 2010).

Technical packet or specification packet—A series of documents that is crucial for the construction and completion of a product. The technical packet contains the following: design sheets, construction sheets, measurement sheets, color ways, technical drawn flats, bills of materials, and cost sheets (Lee & Steen, 2010).

- **Bill of materials (BOM):** This page lists every item that is used in the construction of the product. The page also details such items as the quantity to be used, the vendor, and the trim item number.

- **Color way sheet:** This page has the visual images of the color selections for the product. These images can be Pantone squares or actual images of the fabric colors.

- **Construction details:** This page states in simple and clear language how the product is constructed, from specific types of seams to the number of stitches per inch.

- **Cost sheets:** This page lists every item that is physically used in the construction of the product and the cost of each item. Costs are sometimes rolled in with BOM.

- **Measurement sheet:** This page states what each size needs to measure in specific areas, e.g. chest, front length, or bottom opening. The measurement points are specific to the product.

- **Style summary:** This page contains the basic descriptive information regarding the product. The information can include the company logo, the season, front and back images, and the product style number.
- **Technical drawn flats**: A technical flat or flat is a computer rendering of the product. This is a detailed representation of the product, which shows locations for such items as stitching, measurements, and placements of trims. This can occur on its own page or be included on the style summary, construction details, and measurement sheet (Lee & Steen, 2010).

Woven fabric—Wovens refer to the interlacing of yarns (Kadolph, 2011).
Chapter 2: Literature Review

Research Question and Purpose

The research question guiding this study was: How does a small US apparel company engage in knowledge creation and conversion processes as it develops a product line for market? The purpose of this study was to explore knowledge creation and its conversion within a small apparel company as a product line was developed for market.

Introduction to the Literature Review

The purpose of this literature review was to explore two areas of research. The first was knowledge and its usage within organizations. The apparel industry and the function of knowledge within its product development was the other area. The exploration of knowledge was aimed at gaining understanding through two vantage points: the views from organizational learning (OL) and organizational knowledge (OK). The views included the perspectives about how knowledge appeared in companies, how it was managed, and its role in new product development (NPD). These perspectives provided a structure of discussion for the sections of the literature review.

There are three sections within this chapter, each with a specific area of research discussion. The first section presents various perspectives on knowledge, as well as subtopics within knowledge research. The focus of the second section was on knowledge types and their place within organizations. The final section reviews knowledge from the context of the apparel industry. This section allowed the discussion of knowledge to be framed by the contextual setting of new product development (NPD).
Introduction to Learning and Knowledge

Over the years, OL (organizational learning) theorists have continually discussed how to describe and define knowledge. Many theorists have their own perception of what knowledge entails and whether it exists in an individual or in an organization. Organizational learning (OL) is one avenue of thought about knowledge (Argote & Miron-Spektor, 2011; Shrivastava, 1983). Organizational learning (OL) identifies knowledge as an outcome of learning (Argote & Miron-Spektor; Shrivastava, 1983). Another avenue of thought is the acquisition of knowledge. Huber (1991) states that knowledge is acquired from individuals’ learning processes and their environment. Argote (2005) contributes to the line of thought by viewing knowledge from the perspective of its acquisition processes. As the line of thought expands, the need to re-evaluate the definition of learning and knowledge occurs (Easterby-Smith & Lyles, 2011).

Learning is defined as a process whereby knowledge is obtained. It is thus an achieved outcome (Easterby-Smith & Lyles, 2011). In contrast, knowledge is defined as information that is held by an organization. When knowledge is assumed to be a transition, it becomes an element that can be managed (Vera, Crossan, & Apaydin, 2011). Once knowledge is considered an element, an organization can then manage it. These are central trains of thoughts espoused by theorists within the field of organizational learning (Vera et al., 2011).

The perspective of knowledge as a manageable element brings challenges with it (Kogut & Zander, 1992). One challenge is viewing knowledge as providing a base for an organization. When it is considered as a base, knowledge leads to capabilities in the organization (Kogut & Zander, 1992). These perceptions have redefined knowledge as a combination of ideas, rules, and procedures; therefore as part of the organization’s structure (Bhatt, 2002). Now part of the
structure, knowledge is embedded into an organization’s strategic vision (Vera et al., 2011). With knowledge as part of the vision statement, the organization is able to use it as a resource.

**Organizational Learning**

**Definitions.** There is one point theorists agree on, and that is the lack of consensus on what exactly organizational learning (OL) is (Argote, 2005; Fiol & Lyles, 1985; Shrivastava, 1983). This lack of consensus creates difficulties among the OL researchers because they do not share a common frame of reference. This has hampered the ability of researchers to share and compare research findings, to say nothing of furthering those studies (Shrivastava, 1983). The differences have also prevented OL researchers in coming to an agreement on what is OL (Fiol & Lyles, 1985).

Fiol and Lyles (1985) believe the lack of agreement can be found within the definition of OL along with insights into OL. They have chosen to define OL as a process of improving actions through knowledge and understanding (Fiol & Lyles, 1985), whereas Argyris and Schön (1978) have chosen to define OL as insights or knowledge. OL is being redefined as the years progress, so it is currently more closely focused on an organization’s knowledge that is gained through experience (Argote, 2011). Along with changes in the definition, there have also been changes regarding OL assumptions.

**Assumptions.** Argote’s (2011) research highlights three assumptions about critical elements of OL. They involve the creating, retaining, and transferring of knowledge. On the other hand, Huber (1991) argues there is more to understand in regard to organizational learning. He suggests that OL assumes (1) acquisition of knowledge, (2) distribution of information, (3) interpretation of information, and (4) organizational memory (Huber, 1991). Shrivastava (1983) identifies assumptions that are different from Argote’s (2011) and Huber’s (1991). Shrivastava’s
(1983) assumptions for OL are (1) adaption and assumption sharing, (2) development of a knowledge base, and (3) learning as an experience. Schein (1993) views OL assumptions as various stages of processes which in turn create change in an organization. These assumptions encompass the acquisition of knowledge and insight, as well as habit and skill learning.

Levitt and March (1998) discuss learning from an experience vantage point. OL assumes that one learns from direct experience, from the interpretation of an experience and from others’ experiences (Levitt & March, 1998). While OL theorists do not agree entirely on OL assumptions, there are some commonalities among them. The assumption on the acquisition of knowledge is shared by Huber (1991), Shrivastava (1983), and Schein (1993). Argote and Miron-Skeptor (2011) agree that a common emphasis can be found within the various definitions of OL. They view this commonality as change based on acquired experience that occurs within an organization (Argote & Miron-Skeptor, 2011).

The organization. Theorists have debated whether OL is more than the sum of the knowledge possessed by an individual (Easterby-Smith, Crossan, & Nicolini, 2000). Such a debate poses a question to OL theorists: Who is really learning—the individual or the organization? When OL is viewed at the organizational level, it serves a purpose and fills a need for the organization (Crossan, White, Lane & Djurfeldt, 1995). As the organization learns, its needs are met and outcomes are embedded within its structures, procedures, and systems (Fiol & Lyles, 1985; Shrivastava, 1983). However, Argote and Miron-Skeptor (2011) argue that OL in an organization transpires as a change. Schein (1993) views OL as changes that are created through the various processes within an organization. On the other hand, Easterby-Smith et al. (2000) argue that OL is change, and those changes occur through actions and beliefs of the individual.
Most of today’s OL theorists agree that the change in an organization’s knowledge is a result of an experience (Argote & Ingram, 2000; Cohen & Levinthal, 1990; Crossan, Lane, & White, 1999). Since organizations are capable of learning from their experiences, it follows that they are capable of creating and retaining knowledge (Argote, 2011). According to Argote and Miron-Skeptor (2011), organizational processes need to be in place for learning to be retained after an experience. As activities occur throughout the organization context is provided by these activities. It is within the interaction of these two that knowledge is created and learning occurs. Cohen and Levinthal (1990) have their own version of learning processes and refer to them as actions. These actions consist of knowledge being converted, shared, and transferred as well as being absorbed by individuals (Cohen & Levinthal, 1990).

Crossan et al. (1999) approach the learning experience process from a different point of view when compared to other theorists. Crossan et al.’s (1999) point of view is that the processes occur on multiple levels throughout the organization. The individual level learning process is known as intuiting (Crossan et al., 1999). Learning occurs in this process through a subconscious level and through the development of insights. Subsequently, the process is difficult to verbalize, so metaphors are used to assist in the sharing process (Crossan et al., 1999). When comparing this process with the socialization mode in Nonaka’s (1994) spiral of knowledge, the two are similar in thought but not in specifics. Nevertheless, both theorists agree that at this stage, it is difficult to express learning (Crossan et al., 1999; Nonaka, 1994). Although they do not agree on term usage, they do agree that knowledge at the intuiting/socialization phase is difficult to express, thus making it difficult to share (Nonaka, 1994; Crossan et al., 1999). Crossan et al. (1999) and Nonaka (1994) hold similar viewpoints about the scope of the process.
The next stage in the learning process is *interpreting*, which occurs between individuals and involves their expression of what they know (Crossan et al., 1999). This is viewed as a social activity since it relies on the interaction of individuals. The *integrating process* acts as a bridge as an individual’s knowledge is changed to collective knowledge (Crossan et al., 1999). This collective knowledge is embedded within routines and systems. Therefore, the organization is more than the sum of its collective knowledge (Crossan et al., 1999). Although employees within an organization may come and go, it is the routines and systems that are *institutionalized* that stay (Crossan et al., 1999). Before knowledge can be embedded or shared in an organization, individuals need to understand the new knowledge (Nonaka, 1994).

**Organizational Knowledge**

To an organization, knowledge is more than mere information or content (Teece, 2000). The context in which knowledge occurs adds to its importance. When knowledge is viewed in context, it allows an organization to embed that knowledge within its policies and procedures (Teece, 2000). According to Lyles and Schwenk (1992), knowledge exists within an organization as its internal structure. The internal structure is composed of various concepts, which concern goals and beliefs of the organization (Lyles & Schwenk, 1992). The structure is linked to the strategic survival of the organization and changes as the culture changes. There are two components to organizational knowledge (OK): core and peripheral. The core is a feature in the organization that remains unchanged over long periods, such as beliefs and goals (Lyles & Schwenk, 1992). In contrast, the peripheral components are factors that experience change in an organization (Lyles & Schwenk, 1992).

Kogut and Zander (1992) argue that organizational knowledge (OK) is viewed as the knowledge base of an organization. When the operations of an organization are observable, they
have a base of knowledge. This can be a challenge for OK theorists, as they have to accept that an organization can be knowledge-based. Along with accepting this viewpoint, they also need to gain an understanding of a knowledge-based organization. Until these two viewpoints are accepted, OK will remain focused on how an organization learns, rather than what it knows.

Kogut and Zander (1992) cite two central features to organizational knowledge (OK). One central feature is that an organization is knowledge-based. The other feature is that knowledge is created and transferred within this organizational context (Kogut and Zander, 1992).

Bhatt (2001) argues that organizations have difficulties as they define their knowledge; the reason is that knowledge finds life through the organization. It is from Bhatt’s (2001) perspective that knowledge is defined as an organized set of ideas, policies, and procedures. Bhatt (2001) agrees with Kogut and Zander (1992) that knowledge needs to be distinctive, but as knowledge types rather than specific to an organization. There is a distinction in the knowledge that resides at the individual and organizational levels according to Bhatt (2001). Though the two knowledge levels are distinct, they are mutually dependent on each other. Bhatt (2001) states that organizational knowledge is the combination of the two levels; therefore, organizational knowledge is more than the sum of individuals’ knowledge (Bhatt, 2001).

Knowledge

Knowledge in context. When knowledge is placed in context, it becomes more than information and content (Teece, 2000). When it is regarded as more than mere information, it needs defining and identification (Teece, 2000). Although the terms information and knowledge are used interchangeably, there is a distinction between the two, according to Nonaka (1994). He views information as a flow of messages, which creates and organizes knowledge (Nonaka, 1994).
Bhatt (2002) also considers knowledge to be more than information; it is an organized combination of ideas, rules, and procedures. Polanyi (1996) argues that knowledge is tied to an individual’s senses. It is through the senses that individuals observe and experience knowledge. Alavi and Leidner (2001) agree with Teece (2000) that knowledge is more than information. However, they do not agree with the distinction between knowledge and information (Alavi & Leidner 2001). Their definition of knowledge is found within the structure or content of the information. They believe knowledge is information held within the mind of an individual. When viewing knowledge in this manner, individuals can expand their personal knowledge and apply it to the needs of the organization (Alavi & Leidner, 2001).

Von Krogh (2011) takes a different direction to knowledge. Von Krogh (2011) sees knowledge as a competency-based behavior. When knowledge is viewed as a competent behavior, there are three features contributing to its description. One is that knowledge takes on an importance when it is viewed as the justified beliefs of an individual. The second factor is through an individual’s observations that his or her beliefs are justified. The last contributing factors are the views, values, and experiences of that individual. Knowledge has two additional important features according to von Krogh (2011). One feature is that it is an enabler of action, while the other is that knowledge is both tacit and explicit (von Krogh, 2011).

Types of knowledge. Several terms are used to describe knowledge: from tacit or implicit, to codified, to explicit (Argote & Ingram, 2000; Nonaka, 1994). Tacit or implicit describe knowledge that is hard to express and lies within learned skills (Argote & Ingram, 2000; Nonaka, 1994). Conversely, explicit or codified knowledge (Argote & Ingram, 2000; Nonaka, 1994) is much easier to express verbally and in writing. While researchers may not agree on the terms to express knowledge types, they do agree on their existence.
Argyris (1991) views knowledge from a different angle, one of applicable practice. For this reason, Argyris (1991) argues research needs to highlight applicable knowledge in studies, as this allows the findings to fit into practice. With research taking a practical approach, knowledge needs to be defined accordingly. Argyris (1991) argues two types of knowledge exist when it is applied to practice. Applicable knowledge is defined by the usage of the appropriate knowledge in completion of an activity. Useable knowledge is defined by Argyris (1991) as knowledge used to bring success to a completed activity.

Nonaka’s (1994) view on knowledge is that it is composed of two types, tacit and explicit. Tacit knowledge is specific to an individual, thus making it difficult to express in words (Nonaka, 1994). Tacit knowledge is the skills and experiences of an individual (Polanyi, 1996). Since these are qualities of an individual, they are difficult to articulate and share with others (Polanyi, 1996). Nonaka (1994) views tacit knowledge as consisting of two elements; one is cognitive and the other is technical. Nonaka (1994) states the cognitive element of tacit knowledge is found within the individual’s vision for the future. The technical element in tacit knowledge is the know-how and skills as applied to a specific context (Nonaka, 1994).

Knowledge that is easily expressed through documents, manuals, and presentations is known as explicit (Nonaka, 1994; Polanyi, 1996). Whereas tacit knowledge is capable of standing alone, this is not true for explicit knowledge (Polanyi, 1996). As explicit cannot stand alone, there is a need for the individual to have an understanding of the tacit knowledge that underlies it. Although Nonaka (1994) and Polanyi (1996) both agree on the difficulty in expressing tacit knowledge, they differ in regarding it as a personal belief. Kogut and Zander (1992) consider knowledge as information, unlike the views of Nonaka (1994) and Polanyi (1996), where it is more than information. Kogut and Zander (1992) describe two types of
knowledge, information, and know-how. Information knowledge is defined as knowing what something means. On the other hand, know-how is knowing how something is accomplished (Kogut & Zander, 1992).

Argote and Ingram (2000) define knowledge by using the terms implicit and explicit. Implicit is difficult to articulate, hence tools are used to transfer the knowledge. Argote and Ingram (2000) choose to use the term implicit instead of tacit, but it is still similar to the definition of Nonaka (1994) and Polanyi (1996). Explicit knowledge is described as knowledge that is transferred through practice (Argote & Ingram, 2000). According to Lam (2000), the terms tacit and explicit are new knowledge typology. Although Lam (2000) considers the terms tacit and explicit as new, he shares similar definitions with Nonaka (1994) and Polanyi (1996).

The term explicit knowledge is also used by Alavi and Leidner (2001). They define explicit as including both verbal and communicated knowledge. The knowledge is communicated by means of symbols and manuals. Unlike Kogut and Zander (1992) who describe explicit knowledge as being know-how, they use the term know-what in their definition (Alavi & Leidner, 2001). Alavi & Leidner (2001) acknowledge that tacit knowledge is composed of cognitive and technical elements, thus they agree with Nonaka (1994) on this view. They do part ways when it comes to further defining the elements. The cognitive element exists within the beliefs, mental maps, and viewpoints of an individual. The know-how and craft skills of an individual represent the technical element (Alavi & Liedner, 2001).

Knowledge-Based Activities

Knowledge sharing. Knowledge sharing is an action where tacit or explicit knowledge is exchanged between individuals (Bartol & Shrivastava, 2002). The action of knowledge sharing is influenced by individuals’ willingness to share their knowledge (Yang, 2007).
willingness of the individual contributes to the action of sharing knowledge (Matzler & Mueller, 2011). However, the individual needs to be aware of and open to the action prior to sharing knowledge. The ability to share knowledge is affected by the degree of willingness in an individual (Yang, 2007). The level of willingness is influenced by the fear of ignorance or losing power through the sharing process (Yang, 2007).

A general assumption for shared knowledge is the generation of new and creative ideas by an individual (Huang, Hsieh & He, 2014). Bartol and Shrivastava (2002) argue that for new ideas to be generated, knowledge needs to be shared first. The necessary knowledge can be shared by three methods. These various methods of sharing are through databases, communities of practice, and meetings. The sharing of knowledge by any of these three methods occurs on the individual and organizational levels (Bartol & Shrivastava, 2002). These actions of knowledge sharing generate ideas that can contribute to the competitive advantage of the organization (Matzler & Mueller, 2011). These same actions are the central process for an organization’s management of knowledge. Knowledge sharing is viewed as a best practice in the management of knowledge (von Krogh, 2011). This best practice involves feedback and trial and error as well as making mutual adjustments to the knowledge (von Krogh, 2011).

**Knowledge and group sharing.** Knowledge sharing within groups is influenced by whether members of the group have similar or dissimilar knowledge (Huang et al., 2014). These shared experiences and knowledge allow the group to establish relationships and a common language (Bartol & Shrivastava, 2002). There is a tendency for dissimilar knowledge groups to be more creative with their ideas (Huang et al., 2014). Since members do not share a common understanding, there is a need for a greater explanation when sharing knowledge. On the other hand, a similar knowledge group utilizes their common knowledge and expertise during the
shared knowledge process. Although the group may not generate new ideas, it does contribute to the members’ existing knowledge (Huang et al., 2014).

**Communities of practice.** Communities of practice are groups of individuals who have developed an informal bond (Wenger & Snyder, 2000). This bond is formed when members in the community possess a shared knowledge or expertise. These groups exhibit learning through a shared interaction of knowledge that is gained from other organizations (Bartol & Shrivastava, 2002). Although groups like this provide benefits to an organization from new knowledge, they also bring certain risks (Wenger, McDermott, & Snyder, 2002). The risk to the organization is a loss of proprietary knowledge, thus placing their competitive edge at risk (Wenger et al., 2002). Nevertheless, the gains in knowledge outweigh the risks, as transferred knowledge is the basis of a competitive advantage (Argote & Ingram, 2000).

**Knowledge transfer.** Knowledge transfer is the process in which one unit is affected by another unit’s experience (Argote, Ingram, Levine, & Moreland, 2000). The knowledge transferred between the two units contributes to an organization’s performance, but only if the transfer is successful (Argote & Ingram, 2000). Successful transfer of knowledge occurs when the units have transmitted and absorbed the knowledge (Argote et al., 2000). These two actions rely on one of the units being the transmitter, while the other acts as the receiver (Chowdhury, Butel, Eraslan, & Bakan, 2009). Transfer is successful when the receiving unit has accepted and absorbed the transmitted knowledge (Chowdhury et al., 2009). The usability of the transferred knowledge determines the overall success of the actions (Argote et al., 2000).

King and He (2011) view transfer success differently. Transfer of knowledge is considered complete when it is communicated and applied by the recipient (King & He, 2011). As long as the transfer of knowledge is understood, it is successful. They provide researchers
with different views to determine whether knowledge is transferred or not. King and He (2011) further the discussion of knowledge transfer as it applies to knowledge types. Codified knowledge is easily transferred using documents and manuals. This transferred knowledge will signify the know-what of an organization. When this codified knowledge is accompanied by a discussion or practice, it has included tacit knowledge (King & He, 2011).

**Knowledge Management**

Before an organization can manage its knowledge, it needs to understand exactly what knowledge is, and how it should be used, along with its potential to improve the organization (Tuomi, 1999). After considering these points, it will need to determine what managing knowledge actually entails (Tuomi, 1999). Knowledge management can be viewed as a facilitator of knowledge and supporter of knowledge-based activities (Tuomi, 1999). The processes of sharing and transferring of knowledge are included as activities according to von Krogh (2011) as well as Matzler and Mueller (2011).

These activities are described by Bhatt (2002) as the creation, capturing, and transformation of knowledge. Organizations manage these activities to ensure that knowledge reaches the right people at the right time (Singh, 2008). For this to happen, organizations need to remain flexible and adaptive in their structure (Bhatt, 2002).

The structures provide implementation methods to the management of knowledge (Tuomi, 1999). For this to occur, those structures need to be viewed as processes for the management of knowledge (Tuomi, 1999). The management of knowledge can occur when knowledge is considered as having content. This content could exist as a product, skill, or expertise (Tuomi, 1999).
Bhatt (2001) agrees with Tuomi (1999) that knowledge management is a series of processes. However, Bhatt (2001) views those processes as the learning, reflection, unlearning, and the relearning of knowledge. These processes become vital to the organization as they are used to build its core competencies (Bhatt, 2001). The organization will need to learn how to utilize and share the knowledge, as it manages knowledge through various processes. A structure that allows for open communication will assist in the sharing of the knowledge across boundaries (Bhatt, 2001). The organization will need to have committed and supportive leaders in place to assist with the growth of knowledge management. If knowledge is going to be managed, then management needs to establish an environment that is knowledge-based rather than resource-based (Bhatt, 2001).

**Knowledge-based firms.** Alavi and Denford (2011) bring into focus the support systems that are utilized by a knowledge-based firm. These systems would then support knowledge as being a central dimension. These management systems, which provide support to the firm, are creating, storing, and retrieving of knowledge (Alavi & Denford, 2011). Alavi and Denford (2011) also include the systems of transferring, sharing, and application of knowledge. The system of knowledge creating is supported through two different approaches: one is generation of new knowledge and the other is acquisition of knowledge. The systems used to store and retrieve knowledge provide support to developing and accessing the firm’s memories (Alavi & Denford, 2011). Alavi and Denford (2011) view the terms transferring and sharing as being interchangeable. The transferring system is based on the communication of knowledge, and is viewed as a source to recipient action. The sharing system involves supplying support to the collection of knowledge and its repositories (Alavi & Denford, 2011). The decision-making and
problem-solving of the firm is supported through the knowledge application system (Alavi & Denford, 2011).

Brown and Duguid (1998) view the firm as knowledge-based; therefore, its knowledge cannot be duplicated in the marketplace. Their view provides insight on why firms exist and why knowledge is so critical to them (Brown & Duguid, 1998). Since knowledge is critical to performance in the marketplace, it is considered a firm’s core competency. This competency entails knowing more than what, but also knowing how (Brown & Duguid, 1998). In order to consider a firm as being knowledge based, a few elements must be taken into consideration.

**Knowledge-creating firms.** One element is to view knowledge as residing within individuals, and these individuals are considered part of the firm (Nonaka & Toyama, 2005). By accepting individuals as part of the firm, the firm can now be described as a dynamic entity (Nonaka & Toyama, 2005). As a dynamic entity, the firm can shape and reshape its environment based on interactions with the knowledge creating processes. As the firm is reshaped through their interactions, the firm becomes a knowledge-creating entity, according to Nonaka and Toyama (2005). While a firm can be considered a knowledge-creating entity, the firm’s knowledge does not exist without its employees (Nonaka & Toyama, 2005).

A knowledge-creating firm needs to be composed of various components that support the knowledge processes (Nonaka & Toyama, 2005). These supportive components are dialogue, practice, and driving objectives of the firm (Nonaka & Toyama, 2005). The dialogue component will allow for the synthesis of knowledge, while providing a means of learning the views of others (Nonaka & Toyama, 2005). The driving objectives for a firm can be found within its vision statement (Nonaka & Toyama, 2005). This statement goes beyond the typical mission statement of the firm. Within this statement is the explanation of the why—why the firm is doing
what it does and why it exists (Nonaka & Toyama, 2005). The answers to the why give substance and direction to the firm’s driving objectives. Now with a direction provided, these driving objectives are connected to the dialogue and practice within the firm (Nonaka & Toyama, 2005).

**Transaction or resourced-based firms.** Grant (1996) perceives the firm from a resource-based perspective, as resources are the foundation to the firm’s strategy. The resources become the basic unit of analysis within the firm (Grant, 1996). The resources include capital equipment, the brand name, and employees’ skills. These resources become part of the firm’s capabilities and a main component in its competitive advantage (Grant, 1996). Williamson (1981) takes an economic viewpoint of the firm through transaction costs. These costs will determine the boundary efficiency between the firm and the marketplace. There are three levels to transaction costs in a firm, according to Williamson (1981). One level of transaction occurs in the relationship between operating parts within the firm. Another level can be found within the internal and external activities performed by the firm. The final level is how the firm chooses to organize its human assets (Williamson, 1981).

**Summary.** While Alavi and Denford (2011) view the firm as being knowledge based, Grant (1996) does not hold the same view. For Grant (1996), the knowledge-based view of the firm is an abstract presentation of the real business world. It is abstract in this sense because the firm has been designed to meet a specific set of characteristics. Grant’s (1996) view of the firm is resourced-based, while Williamson’s (1991) view is transaction-based. Brown and Duguid (1998) and Nonaka and Toyama (2005) agree that the firm can be viewed as being knowledge-based. Yet, their perspective is that if a firm is knowledge based it is also a knowledge creating entity and as such its base changes to that of knowledge creating (Nonaka & Toyama, 2005).
**Knowledge and the Competitive Advantage**

Our industries have moved from an industrial era into a knowledge era (Uhl-Bien, Marion & McKelvey, 2007). This has brought with it a new economic landscape, one where firms compete at the global level (Hitt, 1997). This competition drives firms to create knowledge and innovate at a rapid pace (Uhl-Bien et al., 2007). Their survival in the marketplace hinges on their ability to produce both (Uhl-Bien et al., 2007). Competitiveness is determined by a firm’s capabilities and core competencies (Bhatt, 2001). Vera et al. (2011) are among those theorists (Bhatt, 2001; Brown & Duguid, 1998; Teece, 2000) that view knowledge as a key resource toward a competitive advantage. Knowledge is considered an asset as it adds value to a firm, as it is a key resource to competitiveness (Teece, 2000).

**Knowledge assets.** A firm’s knowledge assets are critical components in gaining a competitive edge in the marketplace (Teece, 2000). Bontis (2001) states that the core of the competitive advantage lays in a firm’s knowledge an asset. These assets contribute to sustaining the firm’s competitive advantage within the marketplace (Bontis, 2001). Teece (2000) views knowledge assets as resulting from the experiences and expertise of the individuals within the firm. From this perspective, assets are considered intangible and therefore cannot be sold or bought (Teece, 2000). Since they are intangible by nature, they are hard to measure, so placing a value on them is difficult (Bontis, 2001). However, how a firm chooses to utilize these assets will shape their competitive outcomes and successes (Teece, 2000).

Nonaka et al. (2000) believe that knowledge contained within a firm is best understood when it is considered an asset. Assets are the inputs, outputs, and moderators of the knowledge-creating processes (Nonaka et al., 2000). Nonaka et al. (2000) explain that assets exist in four areas corresponding to the four knowledge modes. An *experiential asset* is common experience
that occurs through the sharing of tacit knowledge (Nonaka et al., 2000). Explicit knowledge as expressed through images and language is a conceptual asset. The actions and practices, which are embedded within tacit knowledge, are *routine assets* (Nonaka et al., 2000). Product specifications and manuals, a form of explicit knowledge, are *systemic assets* for the firm (Nonaka et al., 2000). The firm’s knowledge-creation process will determine how it builds and utilizes its assets over time (Nonaka et al., 2000)

**Knowledge and absorptive capacity.** The value of knowledge is realized and retained only as long as the company is ahead of the competition (Cohen & Levinthal, 1990). Knowledge will lose its value to a firm once it is exposed in a competitive marketplace. This lost knowledge is identified as spillover knowledge (Cohen & Levinthal, 1990). The knowledge retained within the firm, and not exposed to the marketplace, still holds its value. It is this knowledge that contributes to the firm’s *absorptive capacity* (Cohen & Levinthal, 1990). Absorptive capacity is the ability of the firm to possess knowledge. Therefore, the firm’s knowledge becomes greater than the sum of their employees’ knowledge (Cohen & Levinthal, 1990).

Firms have other ways of building their absorptive capacity (Van Wijk, Van Den Bosch & Volberda, 2011). They may create new knowledge through research and development. However, appropriate conditions first need to exist in the firm (Van Wijk et al., 2011). A firm is capable of identifying and recognizing the value of new knowledge. The firm is also capable of assimilating and exploiting this knowledge for commercial ends (Van Wijk et al., 2011). These conditions allow the firm to capture profits that are associated with its innovative efforts. Firms are capable of having two types of absorptive capacity: *realized* and *potential* (Van Wijk et al., 2011). Potential capacity is new knowledge that the firm has acquired or assimilated. Realized capacity occurs when this knowledge is transformed and used by the firm (Van Wijk et al., 2011).
However, Cohen and Levinthal (1990) argue that knowledge needs to exist before it can be assimilated into new knowledge. Once the knowledge is assimilated, the firm realizes its value (Cohen & Levinthal, 1990).

New Product Development (NPD)

Whether the market is fast paced or competitive, the development of new products contributes to the success and survival of a company (Brown & Eisenhardt, 1995). This is why there is such a constant state of renewal within product development. According to Brown and Eisenhardt (1995), this quest for constant renewal of products occurs in several industries. As they explored product development literature, they found it to be fragmented and without a common thread. To provide some continuity to their review, they grouped the research into three areas. One area, rational plan, comprised research on the financial performance aspect of product development. The communication web area is research that explored the effects of communication on the performance of the project. The last area is research that centers on the actual product development process and its influences from teams, suppliers, and leaders (Brown & Eisenhardt, 1995). The following discussions surround the creation and conversion of knowledge during product development. Product development is also discussed as it pertains to the apparel industry and its products.

NPD and knowledge modes. Hoegl and Schulze (2005) acknowledge that new product development is a potential source for new knowledge in organizations. Their focus was on various management methods that supported new product development and its creation of knowledge. These various methods were compiled from the responses of 94 NPD projects. Management employed in the support of product development ten methods. These supportive measures were discussed from the perspective of the knowledge creation modes.
New product knowledge is discussed in both informal and formal settings from workshops to water cooler chats (Hoegl & Schulze, 2005). An informal meeting, such as a chat in the hallway or stopping at an individual’s desk, encourages conversations and knowledge sharing. Informal meetings such as these provide support and demonstrate the knowledge mode of socialization. Various teams conduct workshops as they share their product knowledge and demonstrate the externalization mode of knowledge creation (Hoegl & Schulze, 2005).

Communities of practice are groups of individuals who share common knowledge and goals. Organizations participate in such communities as a means of sharing and transferring product knowledge. These interactions provide support to the knowledge creation mode of combination (Hoegl & Schulze, 2005). Although the general exchange of product knowledge is healthy for an organization, risks are encountered at the same time (Wenger et al., 2002). Yet, the benefit of gaining and exchanging knowledge on product issues outweighs the risks for some organizations (Hoegl & Schulze, 2005; Wenger et al., 2002). Employees of the organization return with new knowledge that is added to existing knowledge (Hoegl & Schulze, 2005). At some point in time, this new knowledge is utilized in the development of new product knowledge, thus supporting the internalization mode of knowledge creation (Hoegl & Schulze, 2005).

With the link between NPD and knowledge creation modes established Schulze and Hoegl’s (2006) research moved toward the phases in NPD. Schulze and Hoegl (2006) reviewed 94 NPD projects from a variety of businesses located in German and Switzerland. Using Nonaka’s (1994) theory of knowledge creation, as a foundation, they connect the knowledge modes to the NPD phases. In doing so, they apply the theory to the project level as the NPD phases provide context for the knowledge modes. Schulze and Hoegl (2006) describe the NPD as consisting of two phases, concept and development. The concept phase is where the product
starts from an idea and takes its form through description. A product’s description is its specifications in terms of its functionality, durability, and cost, to name a few. The development phase is concerned with the product’s concept being interpreted into its design plans.

The *socialization* mode occurs in both the concept and development phases (Schulze & Hoegl, 2006). It is within the concept phase that shared knowledge and expertise by team members contribute to the product idea (Schulze & Hoegl, 2006). When knowledge sharing continues into the development phase, there could be a lack of commitment on the purpose of the product. The indecisiveness on the product can cause delays in its market launch and eventually increase its costs. Schulze and Hoegl (2006) discovered that the socialization of knowledge has a positive influence in the concept phase and in product success. On the other hand, socialization has a negative effect on the product’s success in the development phase. The commitments to the products allow for the building of prototype samples during the development phase. The building of prototype samples is a means of sharing explicit knowledge, thus it supports the knowledge mode of *externalization* (Schulze & Hoegl, 2006). The conversion of tacit to explicit knowledge is demonstrated through the construction of prototypes as the product moves from concept to a sample. The *externalization* of knowledge occurs in the development phase, and not in the concept phase. Any occurrence of externalization in the concept phase results in confusion as the product is still in flux. Schulze and Hoegl (2006) findings did not reveal a positive influence of the externalization of knowledge on the product’s success in this phase.

The concept phase demonstrates the *combination* mode as new product knowledge is created from existing product knowledge (Schulze & Hoegl, 2006). New product ideas are conceived from the knowledge gained from consumer trends and the current capabilities of the company. Schulze and Hoegl (2006) did not find any correlation of the combination mode with
the concept phase. They believe this was due to unrelated issues as companies sought for explicit knowledge. On the other hand, a positive relationship was found between the combination mode and the development phase (Schulze & Hoegl, 2006). The phase allows the NPD team to identify and resolve any technical issues based on similarities with past products. Since the *internalization* knowledge mode exists on an individual level, it does not occur at the group level in either phase. This mode is demonstrated during the concept phase, when product ideas are worked on individually. It is during the development phase that individuals gain a deeper understanding of the product (Schulze & Hoegl, 2006). Figure 5 is a model reflecting the two stages of NPD and their corresponding SECI knowledge modes.

![Figure 5](image)

*Figure 5.* Illustration demonstrating Schulze and Hoegl’s (2006) two stages of NPD and the corresponding SECI modes.

Chang, Tsai, and Tsai (2011) explore knowledge conversion through the NPD stages at 107 small to medium high tech Taiwanese companies. They discovered that knowledge conversion needed to occur within a company that had a complex knowledge structures in place. The structures provided support to the knowledge conversion between the marketing and R&D teams. Chang et al. (2011) describes the NPD process as existing in four stages with each corresponding to a knowledge creation mode (Nonaka, 1994).

First is the planning stage, in which the NPD team’s knowledge is transferred between research and development (R&D) and marketing (Chang et al., 2011). The planning stage is
where the *socialization* mode creates knowledge through the various interactions between teams and departments. Tacit knowledge is shared and transferred through the social interactions of team members, thus providing support to the socialization mode (Chang et al., 2011). As each department turns its focus inward on product ideas, the general knowledge growth of the company at this stage is slowed. Prototypes are constructed during the development stage which leads to the rapid increase in knowledge transfer between research and design (R&D) and marketing (Chang et al., 2011). Feedback is provided to both of these departments when prototypes are tested in the marketplace prior to production. This feedback comes in the form of tacit knowledge which is then analyzed and converted to explicit knowledge.

These two knowledge actions correspond to the externalization (E) mode of knowledge creation (Chang et al., 2011). The greatest quantity of product knowledge is created within the developmental stage of the NPD processes. The marketing stage allows the teams from all the departments to share knowledge with each other. This action by the company corresponds to the knowledge creation mode of *combination* (Chang et al., 2011). At this stage in the NPD processes, the gained knowledge is used to prepare prototypes and premarketing materials for market. The commercial stage in the NPD processes is where companies release their products into market (Chang et al, 2011). Up to this point, the teams have experienced three out of the four knowledge modes as the product has progressed through the various stages of NPD. Each member within the NPD team gains personal knowledge from the experience of placing a product into market. This gained experience, as well as the receiving of product feedback, comprises the internalization mode. Figure 6 is an illustration reflecting the four stages of NPD and their SECI knowledge modes as described by Chang et al. (2011).

Richtnér and Åhlström’s (2010) research contributes to knowledge creation and NPD at the management level. They chose six NPD projects at two companies to determine what influence management has on stimulating knowledge creation. The projects were software programs that were being developed for future use in telecommunications. The findings from Richtnér and Åhlström’s (2010) case study reflect the important effect top management has on knowledge modes. It showed a positive influence on the accumulation of tacit knowledge within the socialization mode (Richtnér & Åhlström, 2010). Yet, on the other hand it had a negative influence on the collection of tacit knowledge inside and outside of the company. Top management had both a positive and negative influence on the externalization mode within the projects (Richtnér & Åhlström, 2010). Management evoked a positive influence when metaphors were allowed to be used as descriptors in the projects. A negative influence occurred when the focus of management was on the delivery of the product.

The influences within the combination mode were both positive and negative (Richtnér and Åhlström, 2010). Positive influences occurred during the creation of explicit details concerning the project. However, when these details were not allowed to be shared with other parts of the company, the influence was negative. The internalization mode was affected by management’s influence both positively and negatively (Richtnér and Åhlström, 2010). When
management pushed the members of the projects to achieve something concrete and progress, it was positive. Yet, when management chose to discourage the exchange of information during meetings, the effect was negative (Richtnér and Åhlström, 2010). Richtnér and Åhlström’s (2010) findings comprised the entire innovation process of NPD. Their findings were not presented according to NPD process steps. Figure 7 is an illustration reflecting the influences of management on the SECI knowledge modes.

![Figure 7. Illustration of SECI modes as influenced by management. Reprinted from “Top Management Control and Knowledge Creation an New Product Development” by A. Richtnér & P. Åhlström, 2010, International Journal of Operations and Production Management, 30(10).](image)

Richtnér, Åhlström, and Goffin (2014) explore NPD and its knowledge creation through the functional areas of a company. These areas include research and design (R&D), marketing, and manufacturing. Richtnér et al. (2014) study examines the organizational slack that occurs at the project level. Organizational slack refers to the capacity of an NPD team and the resources they have available to them. If management provides too much slack, the developmental resources are wasted. On the other hand, if slack is restricted, so is the ability for knowledge creation (Richtnér et al, 2014). If a company decides to remove the slack entirely, it will upset the flow of learning and new ideas of the NPD teams (Amabile & Conti, 1999; Fisher & White, 2000). Richtnér et al. (2014) explored the correlation of organizational slack and its influences on NPD and the SECI modes.
Two companies were selected for the case study, one a telecommunications firm, while the other was a software developer (Richtnér et al., 2014). Three NPD projects were chosen from each company with data being collected and reviewed over a two-year period. The findings demonstrated that an increase in slack had a positive result on a NPD project (Richtnér et al., 2014). When the slack was decreased, there was a negative result on the NPD project. With positive and negative influences of slack identified, Richtnér et al. (2014) applied them to the SECI modes. They discovered that tacit knowledge was sensitive to any change in the organizational slack. They determined that the effectiveness of the SECI modes was reduced, as the slack was reduced. As the slack was increased, the effectiveness of the SEI modes increased accordingly (Richtnér et al., 2014).

Although their study was not relevant to NPD, Lindlöf, Söderberg, and Persson (2013) discussed the linkage between knowledge transfer and lean product development. For that linkage to be realized, the researchers employed a strategy of theory combination. Such a decision allowed them to look through the lens of lean product development framed by knowledge transfer (Lindlöf et al., 2013). Lean product development (LPD) is viewed by researchers as a means of promoting learning and knowledge transfer. The study chose the SECI model by Nonaka (1994) as a basis for analysis. This model was also used by Schulze and Hoegl (2006) to demonstrate the NPD process to the SECI modes (Lindlöf et al., 2013).

With the LPD methods correlated with the SECI modes (Nonaka, 1994), researchers addressed the usage of knowledge transfer in practice (Lindlöf et al., 2013). Information regarding knowledge transfer was gained from Alfredson and Söderberg’s (2009) case studies. From these studies, researchers discovered that knowledge was transferred at the end of R&D (research and development) (Lindlöf et al., 2013). Post project reviews (PPR) were the manner
used to transfer knowledge gained during development. The PPR is a form of learning from the various development activities that occurred through projects (Lindlöf et al., 2013).

After conducting a review of literature on LPD, the researchers developed a list of 24 methods and principles (Lindlöf et al., 2013). These were then reviewed by eight practitioners with experience and knowledge in LPD. These methods were analyzed for the best fit within the SECI model (Lindlöf et al., 2013). The methods that had the best fit with the SECI model (Nonaka, 1994) were mentorship, chief engineer, and visualization. Mentorship referred to an individual’s acting as a supportive teacher or coach (Lindlöf et al., 2013). Lindlöf et al. (2013) aligned this LPD facet to the socialization mode. Chief engineer was aligned with the externalization mode. Lindlöf et al. (2013) believed that this individual acted as a guardian of the product concept. This individual transferred and shared his or her knowledge of the product with the organization (Lindlöf et al., 2013). The last LPD method was that of visualization. Lindlöf et al. (2013) placed this in the combination mode. Visualization occurred through the usage of visual boards. Such tools are powerful methods of transferring and sharing of knowledge in a knowledge-intensive industry. Lindlöf et al. (2013) concluded that LPD would increase the efficiency of lean production. This increase would occur through its correlation to the SECI modes and the effectiveness in the transferring of knowledge. The LPD also addressed the ability to transfer tacit and explicit knowledge in a lean production (Lindlöf et al., 2013).

**NPD is a complex process.** New product development (NPD) is both a complex system and a problem-solving process (Goffin, Koners, Baxter, & Van der Hoven, 2010). A complex system with problem-solving processes evolves from intense knowledge activities, activities that are dependent on knowledge and learning (Goffin & Koners, 2011). Goffin et al. (2010) conducted an in-depth case study with five high tech German companies exploring NPD through
post-project review reports. These reports allowed the companies to examine the lessons learned from the project.

It is through this review process that companies can capture and retain gained knowledge. Their results showed that tacit knowledge was being lost, because it was not captured by the reports (Goffin et al., 2010). NPD teams can be essentially forced to start over, when tacit knowledge lessons are not captured and applied to a similar issue. It takes time for a NPD team to develop and build those problem-solving skills through knowledge-sharing processes (Goffin et al., 2010). If resolutions from product issues are not shared between members, then the previous time was wasted. Teams need to bring forward the knowledge gained through problem-solving and be ready to apply it to a similar issue. The lack of carry-through leads to the poor management of knowledge-intensive activities (Goffin et al., 2010).

These are challenges and key issues as companies manage their knowledge within the phases of NPD (Goffin et al., 2010). One way of addressing these challenges is through the acknowledgement and recognition of employees as a source of tacit knowledge. Such tactics are important in the area of product concept as it utilizes the tacit knowledge of the team (Goffin et al., 2010). For this reason, companies need to encourage knowledge sharing interactions among the NPD teams. Besides the encouragement, companies need to understand what is perceived as important learned tacit knowledge by the NPD teams (Goffin et al., 2010).

**Summary.** The preceding discussions focused on new product development as it related to the knowledge conversion modes. Brown and Eisenhardt (1995) mentioned research in this area could target the actual NPD processes and its influences. Hoegl and Schulze (2005) explored the knowledge conversion modes in NPD at the project team level. They described NPD as having two segments which encompassed the knowledge modes. Schulze and Hoegl
(2006) did have an issue with the internalization mode, as they could not verify its occurrence during their study. Chang et al. (2011) explored the knowledge conversion modes in NPD but at a higher level than Hoegl and Schulze (2005). Chang et al. (2011) investigated NPD and the knowledge modes at the departmental level. Richtnér and Åhlström’s (2010) research demonstrated the effect and influence that management has on the NPD and the knowledge modes. Their research brought the knowledge modes onto a higher level.

Richtnér et al. (2014) illustrated the far-reaching effect of an organization on its own NPD. Richtnér et al. (2014) mentioned that Schulze and Hoegl (2006) are the only researchers to date that had conducted a study at the project level. They also mentioned that the drawback to Schulze and Hoegl’s (2006) study was it had not included observations. Goffin et al. (2010) discussed the NPD process as being a complex system of intense knowledge activities. These activities were dependent on learning from experiences and applying that knowledge to solving issues. Otherwise, the NPD teams will have to start from scratch every time an issue arises during the process. These are challenges for teams and companies, as they understand the importance knowledge has in the NPD processes (Goffin et al., 2010).

**Product Development in the Apparel Industry**

The continual pursuit to develop new products is to meet the demands of the consumer. Still, there is another reason why companies develop products and that is to gain a competitive edge in the markets (D’Amico, Giustiniano, Nenni, & Pirolo, 2013; Tran, Hsuan & Mahnke, 2011). This has caused increased pressure on some apparel companies as they try to meet the growing demands of consumers (Tran et al., 2011). Not all companies develop products within their own organizations; some have chosen to outsource the development for a variety of reasons.
Those who choose to outsource may gain creative input and a chance to accelerate their NPD processes.

**Intermediaries.** There are companies that offer their services toward the development of products, according to Tran et al. (2011). Tran et al. (2011) conducted a case study to gain a deeper understanding of an innovation intermediary’s role in the NPD process of a client. Their analysis of interviews with an intermediary and three of their clients revealed five areas of involvement (Tran et al., 2011). An intermediary could be involved at the planning stage, an early step in the NPD process. Within this stage, trends and client’s markets are identified and defined. Their next step would be to assist in the concept development stage, when concepts and materials are researched (Tran et al., 2011). A third area of involvement is the detailed design stage, when pricing is being determined, along with the creation of sketches and measurements. The next stage deals with the testing of the product through prototypes, as well as developing the pattern and specifications. The last stage of involvement is called production ramp-up. Within this stage, the product is evaluated and promotional materials are sent out to the stores (Tran et al., 2011).

![Figure 8](image_url)

*Figure 8.* Illustration demonstrating Tran et al.’s (2011) five areas of involvement of an innovation intermediary.

Tran et al. (2011) used these five areas to determine the influence and value of an innovation intermediary. The earlier the involvement, the greater value was added to the client’s NPD processes. Value was added to a client’s NPD process by reducing the cost of NPD and product risks along with improving product characteristics. The added value clients gained from
an intermediary was influenced by the amount of their involvement (Tran et al., 2011). The level of involvement was defined as being either simple or complex. Simple involvement occurred at one stage, while complex occurred at multiple stages (Tran et al., 2011). An intermediary can also add value to clients’ NPD process through assisting them in achieving the best cost through sourcing. An intermediary’s capability to solve product issues, market response, and timing are added value to the client. Tran et al. (2011) chose to examine NPD from the intermediary viewpoint and interaction with a client. There are other actors beside intermediaries that are involved with NPD within the apparel industry. These actors are as diverse as the apparel products and the companies that encompass the industry (Tran et al., 2011).

**Supply chain.** Khan et al. (2012) explored in depth the aligning of product development with the supply chain. Their in-depth case study explored the UK’s fastest growing retailer. The study referred to NPD as “new product design process” and not “new product development.” The distinction in the wording is based on designing a product that considers the impact and performance of the supply chain. Their review of literature showed this area to be a key feature in the success of the supply chain (Khan et al., 2012). Another facet of the literature review was the responsiveness of the supply chain as it related to the alignment between the product and the chain. When resources such as design and technical expertise were involved earlier in the development stage, it reduced the time within that stage (Khan et al., 2012). This supports Tran et al.’s (2011) finding that the involvement of intermediaries at the early stage had the same effect.

The aim of Khan et al.’s (2012) case study was to develop an understanding of how a fast fashion company aligns their product design with the supply chain. Khan et al. (2012) have defined a fast fashion company as developing clothing collections from runway trends. These
clothing collections are designed and quickly manufactured in 8 to 12 weeks. Khan et al. (2012) collected data through interviews and observations over a 12-month period. One outcome of the findings was that in aligning of the product design with the supply chain; the company was able to respond to consumer demands more quickly. Khan et al. (2012) determined that product design needed to be the center of the business, so as to drive the development of new products. With the shift to being product-driven, other business operations need to become directly involved at all NPD stages. The alignment between the product and the supply chain increased the responsiveness of the chain, while reducing supply chain risks. Khan et al. (2012) concluded the company’s competitive advantage improved through the alignment of product and supply chain. They also determined that the alignment caused a shift in the organization which allowed it to become a global fast fashion retailer (Khan et al., 2012).

Whereas Khan et al. (2012) view NPD from the chain and retailer activities, Tyler, Heeley, and Bhamra (2006) view NPD from a buyer-driven supply chain. A buyer-driven chain focuses on the combination of low labor costs, skills, and production capacity. Tyler et al. (2006) explored the UK supply chain through three segments—textiles, manufacturer, and the retailer. Each section was an individual case study with data being collected through interviews, site visits, and observations. The studies focused on the NPD stages, the outputs at each stage, the timing, and the people involved at each stage (Tyler et al., 2006). Their findings of the manufacturers revealed that although they put a great deal of energy and resources into their NPD, the consumer selection of the products was low (Tyler et al., 2006). They discovered that weakness in the following areas contributed to the low selection of products: One area of weakness was not adequately developing the product. Other contributors to the weakness were relationships among those involved and a lack of consumer focus (Tyler et al., 2006).
The textiles companies’ findings showed that the timing of trades shows and markets impeded product development. These companies would put their time and effort in with a retailer, only to find out that the product was placed elsewhere. Tyler et al. (2006) argue that this was a major problem as time and money were invested without achieving sales. They also discussed that various individuals, from buyers to planners to merchandisers, all have a hand in the product. This fragmentation presents a level of uncertainty and lack of commitment to the NPD process. Tyler et al. (2006) mentioned a level of uncertainty when placing orders with the textile companies. The retailers that were part of the study had buyers that did not use statistical tools for forecasting. Instead, these buyers relied on their tacit knowledge when forecasting. These individuals made decisions about what styles to order, as well as their size range, color, and quantities. Tyler et al. (2006) also mentioned that these decisions were based on previous sales history. With decisions being made well in advance of sales, products in development will experience changes. These changes can occur up to the time of sales. When changes to the product occur near the time of sales, they can cause disruption at the manufacturing level (Tyler et al., 2006).

**Competencies.** Tyler et al. (2006) mention that the UK buyers had used tacit knowledge in the forecasting of seasonal styles and quantities. Bhatt (2001) refers to knowledge as a competency consisting of skills and experiences within an organization. Such competencies as forecasting become an integral part of the NPD processes. Lin and Piercy (2013) examined small-medium enterprises (SME) involved in NPD and their competencies regarding those processes. They had determined a gap existed in the study of NPD after conducting a review of the existing research. The existing research had focused on large companies, while excluding the area of the creative sectors. The research provided Lin and Piercy (2013) groundwork in which
to develop a listing of competencies for SME. Since a gap existed in the NPD literature, Lin and Piercy (2013) needed to research these competencies as they appeared in fashion literature. They discovered through their review that the NPD processes of the fashion industry differ from those of other sectors.

Lin and Piercy (2013) developed a framework that reflected the inputs and outputs that occurred across the NPD processes on three levels. These levels were antecedents of NPD, competencies, and outcomes. The first level was the required antecedent of individuals involved in the NPD processes. These individuals and their tacit knowledge, skills, and creativity drive the NPD activities (Lin & Piercy, 2013). The various competencies are the second level of the framework. The strategic vision competency refers to the company’s having a vision and enacting on it. The key to this competency lies with the management and their leadership skills (Lin & Piercy, 2013). Companies know that consumers are the key to their competitive position in the market. If they know their consumers and meet their wants and needs, the product can be successful. The usage of the consumer information in NPD reflects the company’s competency level in market orientation (Lin & Piercy, 2013).

Successful management by a SME will lead to a quality product at a reasonable price that has been delivered on time (Lin & Piercy, 2013). The success is achieved through the management of their various operations from purchasing to manufacturing. The degree in which SMEs deals with these factors is related to their operations management capabilities (Lin & Piercy, 2013). The constant need for continual new product development can place a strain on SME operations if planning and relationships with vendors are not maintained. In addition to managing the operations, SMEs need to manage their NPD projects. According to Lin and Piercy (2013), NPD projects in fashion differ from other industries, where there is a start and a
stop. Fashion is known as having concurrent NPD processes. Concurrent NPD processes are known for their overlapping activities, thus, planning is a key in their management (Lin & Piercy, 2013). The best way of describing the competency of project management would be the metaphor of juggling three balls at once (Lindlöf, Söderberg, and Persson, 2013).

Commercialization competency has to do with launching of new products and managing the risks (Lin & Piercy, 2013). There is an element of unknown risk with producing products, as quantity is uncertain. Decisions on what product, how many, and what color are made prior to the product’s reaching the consumer. It is important that SMEs pay close attention to forecasting of trends as well as trends in the market place. Failing to balance the unknown risks with the known information might cause the company issues later (Lin & Piercy, 2013).

Not every product idea will be successful in the marketplace with the consumer; therefore, a product brings a risk (Lin & Piercy, 2013). SMEs need to put as much effort into evaluating product ideas as they do into the generation of the idea. When a balance of effort between management and NPD has occurred, then the product is developed with a chance of success. Part of that management needs to occur by documenting and retaining the knowledge as a product is developed (Lin & Piercy, 2013). SMEs are small enough not to have overwhelming management systems. Nevertheless, they still need to record their agreements and arrangements with their vendors. SMEs manage their knowledge as a means of learning and retaining what has been learned (Lin & Piercy, 2013). The ability to capture and manage the knowledge within the NPD processes is a competency. A network competency is demonstrated by the relationships that are maintained by an SME.

Performance outcomes are the third level of framework developed by Lin and Piercy (2013). One performance measure is consumer-based which refers to the satisfaction and
acceptance of the products. The performance measure on *operations* examines the quality and performance of the product. The *product performance* is defined as how well the product meets set specifications (Lin & Piercy, 2013). The innovation and learning in the NPD is also considered a performance outcome. *Innovation performance* is the consumer’s perception of the product but it is also the timing of the next new product. *Financial performance* includes whether or not the product breaks even and return on investment. Lin and Piercy (2013) suggest their framework reflects the necessity for input and collaboration to occur throughout the NPD processes.

Kachba and Hatakeyama (2015) conducted multiple case studies using eight supply chains that ranged from textiles to finished goods. Brazilian SMEs are faced with challenges as they compete with large companies with brand label connections. Although the brand labels offer a manner of survival, these SMEs want to produce products under their own labels (Kachba & Hatakeyama, 2015). They are faced with doing business with unqualified labor. Labor is not the only challenge for the SMEs. They are challenged by outdated machinery and a lack of knowledge in the management of product development (Kachba & Hatakeyama, 2015). All of these challenges need to be overcome if an SME is going to survive in Brazil’s clothing industry. The SMEs would have a better chance of producing their own brands if they could possess competencies within product development. Kachba and Hatakeyama (2015) suggested that if the companies could develop these competencies, their chances would improve.

Their first task was to determine what competencies were applicable to SMEs (Kachba & Hatakeyama, 2015). A review of literature provided these researchers with five areas of competencies. These were (1) integration, (2) speed, (3) differentiation of products, (4) structure and organization, and (5) tools and technology (Kachba & Hatakeyama, 2015). With these
competencies in mind, they interviewed and observed the clientele, suppliers, and companies. Kachba and Hatakeyama (2015) used these interviews as a means of verifying the application of the competencies to the SMEs. The interview findings revealed a need for competencies but not those gathered from the literature review. The findings revealed seven areas that the SMEs in the study believed were necessary. These competencies were in the areas of: (1) quantity of models developed per year, (2) collaborators in product development, (3) technology and tools utilized, (4) practices in product development, (5) partnerships with retailers, (6) partnerships with suppliers and (7) final consumers (Kachba & Hatakeyama, 2015).

The combined competencies were then assessed by a group of clothing specialists with a minimum of three years in the industry (Kachba & Hatakeyama, 2015). These specialists assessed the importance of each competency that had been gained from the surveys. Their listing of competencies was: (1) integration, (2) speed, (3) differentiation, (4) information, (5) tools and technology, (6) costs, and (7) value. Kachba and Hatakeyama (2015) concluded that (1) integration was a means of sharing information, and (2) technology and tools were related to the speed of product development and grabbing the market share. The competency of speed was related to the ability to develop a larger number of products, while creating a level of difference. As for the cost competency, that contributes to the success of the collection and competiveness within the market (Kachba & Hatakeyama, 2015). The competencies of a company were found to be influential in the NPD processes with Kachba and Hatakeyama (2015) as well as Lin and Piercy (2013).
Table 1

*A Side by Side Comparison of Competencies*

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**The retailer.** Retailers compete against each other as they attempt to capture a consumer’s attention with their products (Gaskill, 1992). Products that are offered in one retailer can at times be found on the floor of a competitor retailer. Retailers strive for ways to put distance between themselves and the competition through product development. The type of retailer influences their approach to product development. Specialty retailers may choose to develop products on their own and contract out the manufacturing of the product (Gaskill, 1992). This would allow for their own label to be placed into the product and appeal to their specific target consumer. They could develop private label products and integrate those products with other competing brands onto the sales floor (Gaskill, 1992).

Gaskill (1992) used a single case study as she explored the in-house activities of product development at a specialty retailer. Gaskill (1992) collected data through open-ended interviews ranging from 15 minutes to two hours in length. Along with the interviews, observations were conducted over a week’s time. The reviews of physical artifacts such as samples and products sketches were added to the collection of data. From the findings, Gaskill (1992) developed a
product development model that had nine areas of activities. The following are those areas of activities in the model (Gaskill, 1992).

- **Trend analysis.** This is the initial starting point of product development. Here decisions are made about a season’s colors, prints and silhouettes. The company in the study utilized shopping trips to Europe as a source for gathering inspirations. It also allowed those on the trip to see what European consumers were wearing.

- **Concept evolution.** All the material collected on the shopping trip, fabrics, garments, and images are compiled and given to the designers. Designers in this stage also collected trends information from forecasting services. These services predict the upcoming colors, fabrics, and silhouettes for future seasons. With trend information from the services in combination with materials from the shopping trip, it is time to make decisions. The last piece of information that is used in deciding the seasonal line is the company’s target market.

- **Palette selection.** With the line concepts in place, the colors that will be used throughout the collection must be decided. The development team needs to determine what colors will sell in the marketplace if used in the collection. Those colors will represent the line’s base colors. Pop colors are used to enhance and catch the consumer’s eyes. Once those are determined, shades and tones of the colors are defined and standards are established. The color palette can exist as 10 to 15 base colors with five to seven pop colors.

- **Fabrication selection.** Fabrication refers to the fabric structure, whether knit or woven. Product development teams will base their choices on past sales history and
their target consumer. The types of silhouettes within the line and the product’s purpose for the consumer need to be considered when choosing fabrications.

• *Fabric design.* This stage combines the decisions from the color palette and the fabrication selection. Product teams utilize computer software to create the various color ways (offering) that are being used in the collection. The color ways (offering) are developed from the information provided by the designers. This information is shared with the mills and sample yardage is requested to evaluate color.

• *Silhouette generation.* The designers interpret the general concept of the collection into silhouettes (styles). These silhouettes take into consideration the trends, and the concepts that were developed and discussed in the previous stages. The target consumer and the merchandising classification influence the silhouettes.

• *Prototype construction and analysis.* This stage is the construction of a first sample or prototype. Prototypes are used to determine whether the initial silhouette lines and features work together. Fitting sessions are conducted with live models, so feedback regarding fit and comfort is received. There are times where revisions are necessary before preceding further with the sample.

• *Line presentation.* This is when the product development team presents the collection to the merchandising team. There are several ways this can be accomplished such as having models wear the prototypes. Another way is through the usage of display boards that have flats of the products along with fabric swatches. Whichever way is chosen, it is a visual presentation of the collection to the merchandising team. The merchandising team will analyze and evaluate the collection based on target consumer and trends.
• *Subsequent activities.* At this point, the merchandising team continues the evaluation of the collection. Once they are satisfied with the collection, they start the production processes. Final costing needs to be negotiated with the mill and orders placed. The merchandisers will locate a manufacturer and negotiate the construction cost of the products. They will request a counter sample from the factory to check the factory’s construction, and one final fit check (Gaskill, 1992).

The retailer used in the study had drawn a distinction between product development and merchandising. The findings revealed that both departments completed various activities that were merchandising tasks. When retailers move from selecting products to developing products, they have a chance to be different. This difference will set them apart from the competitors in the marketplace (Gaskill, 1992).

Gaskill (1992) determined that the NPD process for specialty retailer was composed of a series of sequential stages. Using these events, Gaskill (1992) built the Retail Product Development model. A few years later, Wickett, Gaskill and Damhorst (1999) conducted a study to test the validity of this model. One purpose of the qualitative study was to confirm the accuracy of the established stages. The other purpose was to extend the model to include the post-adoption phase of product development. The parameters of the new study were devised to duplicate the previous one (Wickett et al., 1999). Such a decision by the researchers added validity to the findings along with testing the model. The participants consisted of 21 specialty stores that offered products in men’s, women’s, and children’s. Their sales needed to be 70% to 100% in private label and have access to in-house product development (Wickett et al., 1999).

Phone interviews were conducted as a cost-effective means (Dillman, 1978) and allowed for the sample size to be increased. These semi-structured interviews were geared to five areas:
(1) the company’s private label practices, (2) the participant’s concept of retail product development, (3) stages and decisions made during the development process, (4) steps taken to bring the product into production, and (5) participant’s viewpoint on retail product development as a trend (Wickett et al., 1999). The collected data were analyzed by themes developed using Gaskill’s (1992) model and descriptive process steps from the video by Glock and Kunz (1993). The developed themes were: (1) practices and perceptions of private label, (2) conceptual overview of retail product development, (3) pre-adoption through line adoption in retail product development, (4) post-adoption in retail product development and (5) process perspectives of retail product development (Wickett et al., 1999).

Differences were discovered between the findings as compared to Gaskill’s (1992) model. The first step in the original model was trend analysis, yet the findings indicated the existence of a previous step. This step known as inspirational search of trends was where ideas were collected through various sources (Wickett et al., 1999). These sources included such things as travel, marketing trends, and media. The researchers updated the names of several of the stages to better address the activities taking place in each one. These changes were: (1) concept development to theme development, (2) fabrication selection to structural fabric decisions, (3) palette selection to palette development, and (4) fabric design to fabric surface design direction (Wickett et al., 1999). It was discovered that prototypes sometimes undergo changes due to fabric or color decisions. The researchers (Wickett et al., 1999) added a backwards loop in order to address this backwards motion that may occur in the prototype construction stage. As the product progressed through the stages, there was the potential for a back-and-forth motion in the product’s development. There are times where the product would move backwards because of redevelopment and reevaluation.
The last stage in the Gaskill (1992) model where researchers (Wickett et al., 1999) began their extension was line presentation. The post-adoption stages were developed through Glock and Kunz’s (1993) video, the taxonomy by Kunz (1998), and the responses of the participants. The following are stages in the expansion of Gaskill’s (1992) model:

- **Fit and styling perfecting.** Within this stage, the prototype was fitted and evaluated on a model. Issues regarding the styling or the fit of the product were noted by those technically responsible (Wickett et al., 1999).

- **Production pattern making.** At this stage, the pattern was graded according to the size offering of the product. The existing sample and its corresponding product specifications were used in the developing of production patterns.

- **Materials/garment specification writing.** The materials used in a product should match the desired performance of the product. The way to ensure this was to develop specifications for the materials used in the product.

- **Production sourcing.** This referred to finding a factory that was capable of manufacturing the product. Some companies had their own manufacturing factory, whereas others had to contract out their products. Part of the sourcing was determining whether to place the product order domestically or offshore. The capability and skills of the employees played a factor on deciding the placement of the product.

- **Final cost estimation and specification determination.** The cost of the product is often adjusted as it goes through development. The cost could increase due to changes in the construction of the product or the materials within the product. If the cost were too high for product based on projects, changes would occur to bring the cost down. Specification sheets were developed for each product to ensure their quality. Within these sheets were
sketches of the product, materials to be used in the product, and its finished measurements.

After conducting their study the researchers decided that the revised Gaskill (1992) model needed a more descriptive name; it is now the Retail Apparel Product Development Model (Wickett et al., 1999).

Goworek (2010) chose to conduct research on the NPD stages on a smaller scale. Goworek (2010) situated her multiple case studies within the retail mass markets of the UK. Since the study was conducted at the process level, it was necessary to determine those involved at that point. Goworek (2010) used a review of literature as a means of identifying the industry positions that take part in NPD process stages. The researcher discovered that fashion and textiles designers interact with the NPD process stages, as well as buyers. In order to gain insights to the mass market NPD, Goworek (2010) interviewed two fashion designers, two textile designers, and two buyers. The gained insights dealt with the individuals’ skills and responsibilities for their positions.

From the findings, Goworek (2010) was able to develop a series of common NPD process stages for the mass market. The following are a description of the activities in each of Goworek’s (2010) NPD process stages.

- *Research*. This is the starting point where research is conducted on products trending in the marketplace and on the runway.

- *Directional shopping and comparative shopping*. Directional shopping is trips that are taken by designers and buyers to gather inspiration for new products. Comparative shopping is visiting the competitor’s stores to see what they are carrying in terms of products and at what price. Additional information is collected during
these trips such as technical features of the products and the product’s intended consumer.

- **Fabric source and fabric development.** Fabric selection is included in the creative process in the NPD. Fabric is selected on its appropriateness for the product and the target consumer.

- **Garment design development.** A designer utilizes the forecasted trends from the research stage as a starting point. From this point, designers will interpret and blend various elements of the trends into products that are appropriate for the company’s target market. These products do have to fit into a defined set of parameters such as retail price, performance of the product, and the consumer demand. During this stage technical flats are used as tools to communicate the appearance of the product to others. Design packs containing the specifications for each product are developed and used in the construction of a sample.

- **Garment design presentation.** Garment manufacturers will construct the various products into prototype samples utilizing the design packs. Designers will use the prototypes in their presentations to the buyers. Products may undergo changes due to requests by the buyers. The changes could be to increase the appeal to the consumer or a compromising on the cost.

- **Range planning and selection.** A buyer will plan out the selection and depth of the product collection to be sold in the stores. The buyer’s plan needs to fit into the parameters set by the company. The parameters are in place, so the consumer will commercially accept the collection.
• **Range development and finalization.** With the selection of the products by the buyer, designers work with manufacturers on the bulk production. At this stage, designers sometimes turn over the product to a product technician or developer (Goworek, 2010).

Each stage was further investigated on who was involved and what their responsibilities were in that stage (Goworek, 2010). It was discovered that although buyers and designers have different roles in NPD, they share some of the same responsibilities. The greatest tendency for overlapping according to Goworek (2010) occurred within the stages of research, shopping, and sourcing. The overlap in sourcing and development stages occurs through the CAD (computer aided design) skills of the fashion and textile designer. An overlap occurs in the development stage between fashion designers and buyers, as they both participate in the fitting of a product.

Communication was found to be a critical aspect in each position. These stages of NPD reflect a common NPD process that is utilized by mass-market designers and buyers in the UK (Goworek, 2010).

There are companies in the fashion industry that choose to compete on the international level. Gaskill (1992) discussed NPD from the perspective of specialty retailers and Goworek (2010) looked at it from mass production; still neither of the researchers addressed it at the international level. There are fashion companies that compete at the international level, where NPD is just as critical to their success in the market. Caniato, Caridi, Moretto, Sianesi, and Spina (2013) investigated how an international retailer integrated NPD into the supply chain. They also wanted to discover how characteristics of a foreign country influenced the NPD for the retailer.
Case studies were conducted at 13 Italian fashion retailers that varied in size from small to large as well as their position in the marketplace (Caniato et al., 2013). The companies were either in the mass or luxury markets and produced clothing for men and women as well as underwear. Data were collected over a single season to add internal validity to the findings. Caniato et al. (2013) decided to use two researchers in the data collection process, as this deepens their analysis of the findings. These were collected over one season along with data from websites and various internal documents. The researchers discovered that there were three variables of influence on integration. These variables were the company, the country it exported to, and its performance in the market (Caniato et al., 2013).

The level of involvement of the international group with the NPD process varied from company to company (Caniato et al., 2013). Some companies chose to involve their group at the beginning of the process, others chose to involve the group only within the first three NPD phases. Other factors affecting the involvement are the amount of information shared and when, along with a committed international focused on NPD (Caniato, et al., 2013). Researchers discovered that companies would adapt their NPD practices to align with the country of import. The adaptive NPD practices were meeting cultural standards and timing to the seasons, along with adjusting of fit and size (Caniato et al., 2013). The researchers summarized that the influences and variables on the NPD of a company revealed the existence of three behaviors.

One behavior was related to the involvement of the international group called global approach (Caniato, et al., 2013). This was when the group’s involvement was at a high level and occurred throughout the entire NPD process. Such involvement required that the outbound supply chain had decision capabilities. Internally the group worked on the NPD process full-time (Caniato et al., 2013). Besides these two areas, there was also an extensive sharing of
information between outbound and the internal group. This behavior also utilized the company’s two types of practices, standard and tailored. A standard practice referred to an item such as the expansion of product offerings. The tailored practice item would be specialization of the products.

A hybrid approach was the second behavior, where a company had a high level of international retail but a low turnover in the direct stores (Caniato et al., 2013). The group in this behavior was moderately involved with the NPD process through the final decision. The group’s involvement was sporadic and worked only on a part-time basis with NPD. As within the global approach, the sharing of information is also critical in the hybrid. The last behavior was that of stylist oriented (Caniato et al., 2013). This behavior assumed the stylist was the owner of the NPD process. Stylists’ integration with other individuals was kept to a minimum so as not to hinder their creativity. This type of behavior was demonstrated in companies with low international retail and low turnover from direct stores (Caniato et al., 2013).

Summary. Gaskill (1992) developed and established a working model of the various stages within the NPD process. The stages reflected within the model were those of specialty retailers as they developed private label products (Gaskill, 1992). The model illustrated the NPD process from trend analysis to the presentation of the developed product line. Wickett et al. (1999) continued to build from Gaskill’s (1992) initial research.

Their purpose was to verify the stages in the Gaskill’s (1992) model along with extending the model to the start of production (Wickett et al., 1999). Minor changes were made to the original model because of their research. They discovered a stage that was preliminary to the trend analysis. Before trend analysis, information needed to be collected from various sources. Other changes were in the renaming of certain stages to better describe the actions. The major
contribution of Wicket et al.’s (1999) study was the extension and addition to Gaskill’s (1992) model. Extension stages from the fitting of the product through its approval for production were included. With these new stages added to the model, it illustrated the NPD process from its inspirational start until the product was approved for production (Wickett et al., 1999).

Goworek’s (2010) study presented a model with fewer stages in the NPD process. The stages are used by both fashion and textiles designers along with buyers in the development of products. The model was based on the compiling of the interviews from the various groups. Goworek’s (2010) study revealed there was a greater need for the groups to become interconnected with each other. It was also discovered there was an overlap in development responsibilities. As the UK markets become saturated by imports, the shared knowledge and connection among the groups brought flexibility to their businesses (Goworek, 2010).

The models shared some common stages even though the names were different. They did agree that product development started with some form of research, whether that product research came from sales history, travel, or trades shows. Appendix A lists the models’ stages side-by-side.

**The manufacturer.** Up to now, the articles have discussed NPD without bringing into focus the manufacturer. According to Shih, Agrafiotes and Sinha (2014) the articles that do exist focus on businesses in Europe and the UK. Shih et al. (2014) conduct an in-depth case study on how NPD is utilized by a Taiwanese apparel manufacturer. Theses researchers sought to understand how NPD could make an apparel manufacturer become more competitive. The NW group was an established knit and apparel manufacturer, who was furthering its NPD knowledge and capabilities into the market (Shih et al., 2014). The NW group had approach the market by developing their NPD capabilities as a textile and apparel manufacturer. With the ability to be
both a textile and an apparel manufacturer, NW group had what Shih et al. (2014) called a twofold NPD process.

This twofold NPD process has contributed to the success of the company in five strategic areas (Shih et al., 2014). One strategic area was the adoption of IT (information technology) and technology programs. This allowed for information and resources needed in NPD to be shared quickly and consistently. The implementation of the IT allowed for market and sales information to be shared with buyers and retailers. The ability to offer the designing of product to buyers is known as a value-added service (Shih et al., 2014). Offering other value-added services to buyers, such as textile design and trends forecasting, creates a distinction for the NW Group. Offering in-house design leads to an effective review of the product design, thus preventing issues from occurring in development (Shih et al., 2014).

The NW group introduced sales teams as a measure for reducing NPD cost and time to market (Shih et al., 2014). These teams work with buyers to achieve their desired product. The teams work across departments from marketing to research and design. It is their interaction with other departments that allows them to manage pre-cost and adjust the product according to the buyer’s need (Shih et al, 2014). Even though NW group offers the majority of their services in-house, decisions are still made to outsource some manufacturing. The cost and quality of product is affected by the manufacturing decisions of whether to stay in-house with the product or to outsource. NW Group is working toward controlling the distribution of the final products. Gaining control of this step completes the NPD process and allows the company to become involved with the distribution channels (Shih et al., 2014). Shih et al (2014) stated that apparel and textiles manufacturers could improve their competitiveness in the global market with the success of the twofold NPD process.
Product performance. Up to this point in the literature review, new product development was discussed from the perspective of the supply chain, retailer, and manufacturer. Several researchers have stated that NPD was how a company maintained their competitive edge in the marketplace (D’Amico et al., 2013; Shih et al., 2014; Tran et al., 2011). Nevertheless, for that to happen, the products needed to be purchased by the consumer. Jang, Dickerson, and Hawley’s (2005) study explored the performance of the product in the marketplace based on consumer criteria. They conducted a qualitative study with interviews being the primary source of data. Those companies that participated were located in the Eastern and Midwestern portion of the U.S. (Jang et al., 2005). These companies were chosen because of their activity level in NPD, thus they provided sound knowledge regarding the process. The individual participants experience with the process spanned from six months to 18 years (Jang et al., 2005).

Four themes were discovered from the findings collected through interviews, observations, and annual sales reports (Jang et al., 2005). The researchers used these themes to determine the performance measures for the apparel products. The themes were based on categories established in Griffin and Page’s (1993) study on product development success. In this study, according to Jang et al. (2005), were 16 core success/failure measurements on apparel products. From these findings and the Griffin and Page (1993) study, four areas of performance measures of apparel products were determined by the researchers. These measures were (1) customer acceptance, (2) financial performance, (3) product level, and (4) firm level (Jang et al., 2005).

The measure of customer acceptance included the sales of the product, the satisfaction of the customer, and the product’s market share (Jang et al., 2005). The sales measure was further divided into sell-through, longevity, and growth. A product’s sell-through was how it sold on
the retailer’s floor. *Longevity* referred to the product’s life cycle, and how long it had been
offered to the customer in terms of number of seasons or years (Jang et al., 2005). The *growth* of
the product was a measure of its volume in dollars. *Customer satisfaction* was a measure of how
many products were sold. The *market share* was how the product performed in sales when
compared to competitors. The product was considered successful when all areas were high. It
was possible for the product to underperform in one area, thus causing it to be classed as a failure
(Jang et al., 2005). The financial measure of a product was tied to its profitability in the retail
stores. Success was achieved based on selling the product at full retail price, or making gross
margin (Jang et al., 2005).

The product measures dealt with the value the product brought to the customer, along
with how the product could be adapted or improved (Jang et al., 2005). Products were also
measured by the additional interest they created in other products in the line or in the brand. A
measure of success for a product is how it mixes with the rest of the line as well as its cost
efficiency in manufacturing. Customers look for *value* as in fit and ease of wear in their products
(Jang et al., 2005). Participants also mentioned that customers gained valued when the product
trend was right, along with the price. When the product was able to be *adapted* or changed
slightly and still was of interest to the customer that was considered a success. When the
customer valued a product, this created an *excitement* for other brand products (Jang et al., 2005).
Value added excitement to the brand, hence the product was deemed as successful. Success of a
product was determined by its manufacturing costs, that is, whether the fabric order had been
utilized completely (Jang et al., 2005). If raw materials were left over and not used for additional
orders, they would be sold at a reduced price. Such actions reflected on the product, which did
not therefore achieve success. A product’s success was also measured at the company level, where it contributed to the business and the growth of the brand (Jang et al., 2005).

**Summary.** These measures of success or failure find their way back into the NDP process. Products would be changed to increase their value to the customer and sell-through on the retail floor. These in turn would increase the interest in other products and drive the growth of the brand.

**Consumer focus.** With the apparel industry being consumer-driven, there is a continual arrival of new products into the retail stores (Bhardwaj & Fairhurst, 2010). May-Plumlee and Little’s (2005) study examined how consumer responses could be part of the NPD process. The researchers approached the study by utilizing three methods. The first was examining the EMB (Engle, Blackwell & Miniard) model developed by Engle, Blackwell, and Miniard (1995). The second method was to use the May-Plumlee’s (1999) evaluation criteria as a basis for the alternate choices consumers made toward products. The last was the usage of no-interval coherently phased product development (NICPPD) model as the starting point for a new model (May-Plumlee & Little, 1998).

May-Plumlee & Little (2005) utilized a model developed by Engle, Kollat and Blackwell (1968) that illustrated the decision making process of a consumer. The process demonstrated the consumer’s recognition of a need to purchase a product (May-Plumlee & Little, 2005). With the need defined, consumers continued with decision-making as they performed a pre-evaluation on the product or products. Once the product was purchased, consumers would perform a post-evaluation on the product to determine a need for a possible repurchase (May-Plumlee & Little, 2005). The innovativeness of a product would cause a desire within consumers to trigger their
need for the product. With products lacking distinctiveness, consumers used criteria such as color, style, price, or brand in their purchase decisions (May-Plumlee & Little, 2005).

These two methods were merged with the NICPPD (no-interval coherently phased product development) model. The consumer purchase decisions from the EMB model (Engle et al., 1995) was interfaced with the NICPPD model (May-Plumlee & Little, 1998) along with the evaluation criteria. The interfacing and merging of the three methods created a new model for product development. The PPDICR model (proactive product development integration consumer requirements) reflected areas where consumer input could be utilized in the development of products (May-Plumlee & Little, 2005). While theoretically based it did present areas for additional research and the integration of multiple research projects. Yet, on the more practical side, its use in the development of products is more reflective of the consumer (May-Plumlee & Little, 2005). These three methods allowed the new model to reflect a proactive stance toward product development (May-Plumlee & Little, 1998).

May-Plumlee and Little (2005) defined points of entry in the NPD process where consumer responses would contribute to the product. Kincade, Regan, and Gibson (2007) proceeded along a similar line but through the mass customization of the product. The mass customization focused on consumers and not the design of the product. Such programs offered consumers choices in the area of made-to-measure or consumer design. Up until now, the NPD process has been considered a linear process with sequential stages in the development of the product. In order to incorporate mass customization options, the NPD process activities needed realignment. Kincade et al. (2007) explored the mass customization of apparel products through a qualitative case study. They utilized concurrent engineering methods as a means to realigning a linear process (Kincade et al., 2007). Concurrent engineering is an integrated approach to the
design of a product (Regan, 1997). It took into consideration the product activities from concept down to the final stage of end use by the consumer (Regan, 1997). Their study consisted of three apparel manufacturers, one from each category of men’s, women’s, and children’s (Kincade et al., 2007).

A focus group was established at each manufacturer that resulted in a sample size of 36 participants. Surveys, questionnaires, interviews, and observations were used by Kincade et al. (2007) in the collection of data. Focus groups were given a listing of operational statements used in concurrent engineering to confirm their usage at their company. Next, the groups were asked to respond to a survey where product development activities were sorted into concurrent engineering areas. The last area of data collection dealt with group meetings. During these meetings, the assigned researcher presented the participants with a questionnaire. The questionnaire was to determine whether there would be a change in time-to-market if concurrent engineering were used in product development (Kincade et al., 2007). Time-to-market referred to the time frame that occurred between concepts of the product until it reached the retail store (Kincade & Gibson, 2010).

The results showed several product development activities could be moved in order to compress the overall process and shorten the time to market (Kincade et al., 2007). The traditional sequences had been divided into early, middle, and late phases. The costing of the product moved from a late phase into a middle phase. The usage of technology such as entering line sheets or compiling a color library moved from an early phase into the middle. The resulting movements were based on previous location in a traditional sequence (Kincade et al., 2007). Through the movement and realignment of these activities, the time it took to develop a product could be compressed. This compressed time frame would allow consumer demands to be closer
to the development of the product. The compressed time also would allow for manufacturers and retailers to offer consumers the option of mass customization (Kincade et al., 2007).

**Summary.** These studies suggested that companies could move toward being more consumer-centric by reviewing their NPD stages. May-Plumlee and Little (2005) discussed avenues where consumer responses could be integrated into NPD. They believed that through the incorporation of consumer responses, the products would better match demands. Kincade et al. (2007) approached consumer demands through mass customization of products. For mass customization to be offered to consumers, product development processes needed to be rethought. This new way of thinking was to approach NPD process through concurrent engineering strategies. Various NPD activities were moved and realigned. In addition to the realignment, researchers also identified activities that could occur at the same time. The advantage to a company would be a closer match to consumer demand and a shortened time for the product to reach the market.

**Implications and Conclusions**

This review of literature has presented two perspectives on knowledge. One of those perspectives on knowledge was through an organizational learning lens. The other perspective was through the lens of organizational knowledge. With an understanding of knowledge by definition and types, the discussions changed direction toward topics that were influenced by or that influenced knowledge. These discussions approached knowledge from different vantage points. One point of the discussions surrounded the actions of sharing and transferring via group and through communities of practice. The second point was discussing knowledge as a contributing factor to a company’s competitive advantage. A third vantage point was derived from the contributions that knowledge made to a competitive advantage. Those contributions
were in the form of knowledge creation that led to the innovation of new products. These new products were constantly being developed as a means of maintaining a competitive edge.

The innovation of new products (NP) offered a fourth vantage point to knowledge as the discussions moved toward its application. The discussions and the review of literature turned to focus on knowledge and its presence in new product development. A gap began to form, as less research was available regarding knowledge creation and new product development (NPD). This gap continued to grow as the literature review explored the NPD research within the apparel industry. Just as with knowledge, NPD in the apparel industry was approached from a few different perspectives. Those different perspectives were a retail standpoint, a consumer response to the product, performance of the product, and the process itself. Even with these different views on NPD in the apparel industry, the research gap widened, as they did not consider knowledge creation or conversion.

This study’s objective was to explore knowledge creation and conversion of NPD in the apparel industry. The following chapter outlines the manner in which the study was conducted along with identifying the participants and the site. Within this chapter are also the various protocols used in the collection and storage of the data. As with all research, the validity and reliability become a concern; these are also addressed along with potential biases.
Chapter 3: Research Methods

Introduction

The purpose of this chapter was to present the research methods used for this study. The chapter is divided into five main sections; each contributes to a comprehensive description of the process which was used for the study. The first section outlines the research methodology as well as restating the research purpose and question. The second section discusses the design of the study as well as its chosen methodology. The third section reviews the research strategies of this study as they pertained to the collection of data. Included in this section is a discussion regarding the methods which were used to secure and protect the data. Descriptions of the research protocols, as well as the coding and analysis of the data, are included in the fourth section. The concluding section describes the protocols that were put in place to protect the participants of this study. Within this section, concerns regarding the validity and impact to the study are addressed.

Research Question

The question that guided this case study was: How does a small US apparel company engage in the knowledge creation and conversion processes as it develops a product line for market?

Qualitative Research

A qualitative research approach was chosen for the study by the researcher. Such an approach permitted the researcher to explore the knowledge phenomena through the eyes of the participants. Qualitative research was an exploration on a certain topic and its influences and perspectives of those involved (Merriam & Tisdell, 2015). By conducting a qualitative study, researchers sought to gain an understanding on how individuals made sense of the topic in their
world. Individuals will try to make sense of the topic through their involvement and experiences. This was a key to this qualitative study, as the researcher gained an understanding of the topic through the perspective of the participants (Merriam & Tisdell, 2015). This understanding was gained through the interviews and observations that occurred at Company C as the researcher chatted with the participants on how knowledge was shared among those involved.

Yin (2016) states that qualitative research has five distinctive features. The first two focus on the participants by examining the meaning of their lives and presenting their perspectives. These are captured through social interaction with the participants and the journaling of those actions. The study’s field notes and interview transcripts shed light on the various participants and their opinions. These sources of data provided value and rich descriptive details to the study’s findings. Studying the participants within a contextual situation is a fourth feature in qualitative research. Yin (2016) also mentions that qualitative research needs to be conducted with multiple sources, and not a single source. The study used several different data sources from interviews and observations to that of tech packs and samples. The usages of multiple sources are important when conducting a case study.

Case Study

This study was the exploration of knowledge creation and conversion; such a topic called for a comprehensive and in-depth approach. Since the study was exploratory, it was placed in a contextual setting that resulted in insights and understandings. Case studies provide researchers avenues that allow for such a pursuit, where the interest can be explored in real-world context (Crowe, Creswell, Robertson, Huby, Avery & Sheikh, 2011). In order to gain context, researchers develop case study questions that incorporate how, who and why (Farquhar, 2012). A well-crafted question provides the opportunities and the foundation to probe for answers. Not
only do the words provide context, they also contribute insights and understandings to the researcher. Merriam (1998) and Creswell (2013) mention that case studies are bound by their description and their focus of interest. Therefore, cases are often viewed as a single entity, whether they are individuals, groups, or a type of phenomena. On the other hand, Yin (2009) and Stake (1978) view these cases as being determined by the context and characteristics of the study. The decisions that researchers make, from the wording of their questions to the descriptions of their study, are all contributing factors to the type of case study (Farquhar, 2012, Merriam, 1998, Stake, 1978 & Yin, 2009).

The research was conducted using Stake’s (2000) approach to case studies. He identifies a study that is complex and holistic in nature as intrinsic. Intrinsic cases are used when seeking an understanding of a unique phenomenon (Stake, 2000). Such is the situation with this case of knowledge creation and conversion, as seen through apparel product development. This type of study was appropriate as the researcher’s role was that of an insider-participant. With the study being an intrinsic case, there was flexibility to discover and interpret the findings (Boblin, Ireland, Kirkpatrick & Robertson, 2013; Stake, 2000).

**Research Paradigm**

The paradigm that has the same intent as an intrinsic case study is interpretivism (Ponterotto, 2005; 2010). This paradigm provided support for the descriptive characteristics that emerged through the voices of the participants. These voices added value and context to the research questions and emerged through the study’s findings (Ponterotto, 2005). Those voices were captured through the social interaction of interviews with the participants. The rich descriptive findings revealed the multiple realities that were held by the participants.
The study’s goal was to gain an understanding of a phenomenon, knowledge. It gained that understanding as it focused on the context of knowledge, product development (Ponterotto, 2005; 2010). Researchers choose a paradigm that acts as a guide as they develop the various elements of their studies. The chosen paradigm and the other elements need to align and complement each other (Ponterotto, 2010). The assumptions of the chosen paradigm deal with other aspects of the study not related to its design. Nevertheless, these various research pieces must still fit together and work in unison in the end. The alignment of the elements and paradigm becomes the point of perspective for the researcher and is interwoven throughout the study’s design (Ponterotto, 2005).

**Sampling and the Site**

**Sampling strategy.** The sampling strategy used for this study was aligned with the purpose of the study which was to explore knowledge creation and conversion. The product development department in an apparel company served as the research site. These research features led to the selection of purposeful sampling. Researchers choose this strategy for their studies when they are seeking information-rich data (Creswell, 2013; Palinkas, Horwitz, Green, Wilson, Duan, & Hoagwood, 2015; Patton, 200).

However, this type of sampling strategy does have the potential for appearing biased. This is because of the specific decisions that a researcher makes about the study’s site and participants (Ritchie, Lewis & El am, 2003). Granted, specific decisions were made by this researcher on the type of company and the department that was used for the study. These decisions were related to the research question and purpose, thus continuing the alignment among the elements of the study. Such pragmatic decisions by researchers can be viewed as biases. This is especially true when the participants share the same interest in what is being
studied (Taylor, 2007). However, the participants of this study do not share an interest in the creation and conversion of knowledge. Their interests lay in the area of product development and the apparel industry. For these reasons, possible biases in the sampling selection have been averted.

**Site profile.** Company C, an apparel manufacturer located in the southern portion of Massachusetts, served as the site for the study. Company C runs their operations out of an industrial building that house both offices and warehouse space. This dual usage of space allows their 85 employees and finished products to be housed under one roof. Within the confines of the 126,000-square-foot building is a warehouse that contains over one million products, ready to be shipped out.

As an apparel company, Company C has a registered NAICS (North American Industry Classification System) code with the federal government. NACIS codes are under the direction of the Office of Management and Budget of the federal government (What is NAICS and how is it used?, 2016). These codes allow the federal government to collect statistical data, which are used for the analysis of the U.S. economy. Nevertheless, the codes are assigned to businesses based on their primary activity by the U.S. Census Bureau. The bureau’s records identify 1065 industries within the U.S. as of 2012 (How does NAICS 2012 differ from NAICS 2007?, 2016). The code reflects their primary activity as being a manufacturer of men’s and boy’s suit, coat and overcoats (NACIS 2007 definitions, 2016). Although the code reflects mainly manufacturing for men and boys, Company C does produce product for women.

Company C offers a wide range of outerwear for men, women, and youth along with tops and bottoms. Their outerwear consists of jackets, parkas, and vests. Some of the products offer consumers outerwear that will keep them dry, while other products offer warmth for the winter
and comfort for the summer. This company was selected for two reasons by the researcher. The first reason was its close proximity, which allowed for observations and collection of data. The other reason and the most important aspect was that the company had their own product development department on site.

**Access to site.** The researcher chose to reach out to Annie regarding gaining access to Company C. An email was sent to Annie requesting her assistance in gaining access to the company along with her serving as the study’s gatekeeper. A document (Appendix B) detailed the expectations of the gatekeeper and a short overview of the study for Annie.

**Participant overview.** These individuals worked at the company in its product development department. The individuals were asked to participate in the study and provided the findings with contextual meanings. The participants brought their knowledge and expertise to the study; they ranged from three to 25 years on the job. Those participating in the study were (1) designer; (2) director of product development; (3) technical designer; (4) production manager of wovens; (5) production manager of knits, and (6) assistant production manager.

Table 2

*Summary of Participants from the Product Development Department*

<table>
<thead>
<tr>
<th>Position</th>
<th>Years of Industry Experience</th>
<th>Years with Company C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designer</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Director of Product Development</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Technical Designer</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Knit Production Manager</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Woven Production Manager</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Assistant Production Manager</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Protection of Participants

When participants are involved in a research study, an ethical issue needs to be addressed by the researcher (Taylor, 2007). The issue is concerned with the humane treatment and rights of the study’s participants. The treatment and rights of human subjects during the course of a study are regulated by the federal government (Belmont Report, 1979; Protection of Human Subjects, 2009). They have mandated this through the goals of the protection of human subjects (45 CFR 46) policy.

Student researchers are required to complete training regarding the protection of human subjects (Appendix B). An approved IRB (Institutional Review Board) application (Appendix C) was obtained prior to any outreach to the participants or research site. This study was conducted with protocols that ensured the humane treatment of the participants. The approval of the documents is to ensure that ethical issues between the researcher and the participants have been addressed. It is also to ensure that participants are not placed at risk and are treated with respect and humanely. Protocols were utilized to prevent ethical issues from occurring during the course of the study and bringing the integrity of the findings into question (Bloomberg & Volpe, 2012).

Protocols. The following protocols were included in the IRB application for this study. They have met the established standards for the protection of human subjects.

Access to site and participants. The first series of protocols regarded access to the site and the participants. When approval to conduct the study was received, a request was sent to Annie. This request was for Annie’s participation as the gatekeeper and for her assistance in gaining access to Company C. The gatekeeper/access request (Appendix D) conveyed the
purpose of the study and its duration, as well as an overall view of the study. Annie was able to gain access to Company C as the site for the study, as well as accepting the role of gatekeeper.

Once access had been achieved, the next protocol detailed the contact method of potential participants. Annie supplied names and contact information for these individuals. A recruitment letter (Appendix E) was sent to each potential participant asking for his or her participation in the study. The letter described how their participation through interviews and observations would occur during the course of the study. A brief explanation of the study and an introduction from the researcher were included in the letter.

The last participant protocol detailed the rights of each participant in a letter of consent (Appendix F). This letter informed participants of their rights which included being treated with respect and anonymity. It also informed participants that they had the right at any time to withdraw from the study without fear of reprisal. The letter was presented and discussed with each individual after he or she agreed to be a participant.

**Interviews.** Communication with the participants occurred through emails after they were informed about the study through the recruitment letter. Once they agreed to participate, it was possible to establish an interview. At this interview, the researcher discussed the letter of consent (Appendix F) in detail to ensure the participant clearly understood the process and the study. This discussion surrounding the letter of consent is part of the interview protocol of the first meeting. This needed to be addressed first, so that the participant had a clear understanding of the activities prior to starting the interview. An interview script (Appendix G) was developed to assist in maintaining a consistency with the interviews.

**Observations.** Participants were made aware of the fact that observations would be conducted by the researcher in the recruitment letter (Appendix E). The observation protocol
(Appendix H) was discussed with each participant at the same time as the letter of consent. Notes were taken that detailed the interactions between the participants and the reason for the activity. These notes were later transcribed into the observation field notes template (Appendix I).

**Data.** The data that were reviewed and collected were considered sensitive in nature, thus proprietary. A proprietary protocol (Appendix J) was written for the safe handling and storage of such information. This protocol does not prevent the future use of the findings in later publications. The documents and samples that were reviewed in time will become part of the public domain. As for the company and the participants, they were given false names in order to protect their identity. If the findings are used in later publications, the same safeguards will be used to maintain their confidentiality.

**Data Collection**

The data collected for this study consisted of both primary and secondary sources. The primary sources of data for this study were the observations and interviews of the participants. Various documents and artifacts served as the secondary sources of data. A collection protocol (Appendix K) was developed and utilized during the collection process.

**Primary Sources**

The primary data sources for the study were the interviews with the participants and their observed interactions.

**Interviews.** Participant interviews were conducted in each of their offices. However, since Annie and Mary have a shared and open workspace, an empty office was utilized for their interviews. The enclosed and private space allowed participants to speak and not be heard by others. Two sets of questions were developed for the participant interviews (see Table 3 and
Table 4). The first set allowed the researcher to probe for how the participant viewed the sharing of knowledge. The second set of questions allowed the participants to tell their background story (Jacob & Furgerson, 2012). The background story is similar to “tell me about yourself” (see Table 4). The questions that were developed and asked of the participants had an open-ended structure. These types of questions were more appropriate to a semi-structured interview process. Yet, to place the participants at ease, the researcher asked the questions in a casual conversation manner.

Table 3

Knowledge-Based Interview Questions

1. Who do you receive information from
2. Who do you share information with
3. What information is shared with you
4. What information do you share with others
5. How is information shared with you
6. How do you share information with others
7. When is information shared with you
8. When do you share information with others

Table 4

Tell Me About Yourself Interview Questions

1. How long have you been working in the apparel industry?
2. How did you get your start in the industry?
3. How long have you been with the company?

Procedure. Before beginning each interview, participants were informed that the session was being recorded and that they could stop it at any time. They were also reminded of their rights and their ability to withdraw from the study at any time. The study utilized the voice
memo application on an iPhone to record the interview. Each participant was supplied with a written transcription of the interview within 48 hours. The interviews were kept to 60 minutes or less as this prevented interference with the daily activity of each participant (Jacob & Furgerson, 2012; Rubin & Rubin, 2012). If an interview exceeded the allotted time, arrangements would be made with the participant to either extend the interview or schedule another one. These additional interviews were only arranged if both parties believed there was a need for follow-up questions. The interview questions had a common thread running through them.

**Transcriptions.** These interviews were captured by audio files and sent to a transcription service called Rev.com. This company transcribed the audio files and returned them within 24 hours of their receipt. A comparison of the stored audio file with the transcribed copy was conducted for each interview. This allowed the researcher to notice any inflections or breaks in speech which were not reflected in the transcript. Once the transcripts had been reviewed, they were properly stored in accordance with the developed *proprietary protocol* (Appendix J). An electronic copy of the transcribed interview was sent to each participant. If a participant made changes, they were noted and placed into the participant’s folder.

**Observations.** Researchers often choose to record observations in a field notebook. Notes of this type assist in capturing the context of the *what*, the *why*, and the *when* of the observed situation (Farquhar, 2012). When observing an event or a situation, researchers enter quick perceptions in their field notes. Field notes contain the impressions and perceptions of various observations as viewed by the observer. Such notes are transcribed and reviewed within a few hours of the observation; otherwise, the observer cannot recall the details of the situation clearly. These notes help when summarizing the day’s events after observation, but as Farquhar (2012) points out that notes are only as good as the observer’s eye for detail.
Observations for a study are characterized as being formal or informal in nature. To clarify, a formal observation would be a scheduled meeting or discussion. An informal observation is defined by the actions of the participants, such as a side conversation or a situation. It is assumed that such observations as a weekly meeting, discussions of product fit, or product evaluation could occur during the collection of data. No matter the type of observation, each contributed context and meaning to the findings. The agendas for meetings differed from department to department and at times included action items or the product issues. The design department discussions focused on color review for the upcoming season as well possible new styles. The technical services conversations varied as they focused on developing a new style to addressing issues with a factory. Various situations were observed during the course of the study and they were recorded in the field notebook. The conducted observations dealt with the exchange of knowledge and information between various participants. As these observations were a primary data source, it was important for the researcher to avoid taking an active role during the situations.

**Field notes.** Field notes were used to capture the exchanges that occurred during observations and interviews at the study site. These notes (Appendix I) were referred to during the analysis of the findings, as they contributed to the overall context. On a daily basis, the notes were transcribed and reviewed using Microsoft Word. The action of reviewing and re-reading of notes added insight into the knowledge phenomenon (Farquhar, 2012). These activities required the researcher to interact with the data on a continual basis, which allowed for the detection of emerging themes (Miles, Huberman & Saldaña, 2014).
Secondary Sources

Secondary data sources were documents and artifacts that captured and stored the information and knowledge on the products. The participants used these sources during their interactions as points of reference. As each document (Appendix K) or artifact (Appendix L) was reviewed notes were taken and entered into its corresponding review notes template.

Documents. The review of the documents was two-fold. One purpose was to gain insight to the company itself by reviewing the product catalogues and the website. From the review of these documents, it was discovered how the company projects itself to the market and the client. The other direction was the review of various documents that are utilized in the development of a product. Documents varied by department but also by the purpose they served to the department. The design department kept documents called mood and fabric boards for the current and pending seasonal lines. The documents used in the technical services department were product-specific and housed on their computers. Both production managers used Excel sheets as tracking tools for their products. These documents represent what is called a paper trail that is utilized by the product development department. These documents consisted of line sheets, time action calendars, and product technical packets. The documents had the potential to be product- or season-specific and referenced by all participants.

Artifacts. Artifacts were those secondary sources that included samples, fabric, and trim binders. A sample is used as physical reference of a product and has a specific purpose. Samples submitted by factories are used to evaluate construction, whereas a prototype is used in the development of a product. A sample library is maintained and served as a reference point during the evaluation of the product. Fabric and trim binders are also considered artifacts. These binders hold samples of fabric and trim lab dips that are used as color and quality reference
points. The artifacts of samples and binders fall under the responsibility of technical services to maintain and keep up to date.

**Data Storage**

All sources of data whether a document or an artifact were considered proprietary, and were handled and stored as developed through the storage protocols (Appendix M). The researcher did not remove any proprietary documents or physical samples from the site. Annie did provide the researcher with computer copies of technical packets so they could be reviewed, preventing any breach of the company’s database. The tracking sheets, document review sheets, and other findings were secured within the home office of the researcher. These hard copy documents were properly secured in a lock cabinet.

The researcher utilized a laptop attached to an external hard drive when visiting Company C. At the end of each visit, the notes were compiled and placed into a folder designated and organized by date. These folders were transferred to the home computer and an external hard drive, which created multiple backup copies. The storage devices and backup copies provided protection against possible file corruption and loss of work. Each of these devices was protected with a password which only the researcher knew.

All physical documents collected have been planned for destruction at the end of the study by using a shredding device. The deletion of electronic files stored on the computer and external drive is planned to occur at the end of the study. All materials collected and utilized during the course of the study are scheduled for destruction after the dissertation defense. There is a possibility that, after the defense, the destruction may be postponed. The postponement would occur so that the materials could be used for future articles. If this is the case, then the findings are to remain secure for an additional three years.
Data Analysis of Findings

Stuckey (2015) suggests thinking of the data analysis as a storyline. The storyline relates to the research question or questions. Reading through field notes and interview transcripts on a daily basis helps develop this storyline. The codes used for the analysis, whether predetermined or created, feed back into the storyline. The codes for this study were created through multiple readings and feedback into the research question. The collected data underwent a two-cycle coding process that resulted in the emergence of themes. Prior to the coding processes, the findings were organized and grouped by primary and secondary sources.

Coding

Coding is used to bring some type of order and structure to the large quantity of data that is collected during research (Bloomberg & Volpe, 2012). The researcher chose coding types that aligned and supported the other research elements in the study. These chosen coding types were influenced by the research design and played an important part toward the final analysis of the data. Each coding step and its analysis of the data allowed an insight into the participant’s world (Kelliher, 2005). As the researcher’s insight grew, so did the understanding of the knowledge phenomena. The two-cycle coding process allowed the researcher to manage the large quantity of data that had been collected at the site. The first cycle coding utilized the methods of *in vivo*, process, and value. The methods used in the second cycle coding were narrative descriptive, patterns, and matrix display (Miles et al., 2014). It was through these two cycles and their three-step processes that the commonalities and themes of the study eventually emerged.

**First cycle coding.** This cycle allowed the researcher to group the data into large chunks of manageable information. The coding method of *in vivo* was used first in the analysis of the findings. This allowed for the voices of the participants to emerge from the findings. These
voices would be heard again through the second cycle process of *narrative descriptive*. The *process* method brought the various interactions captured through the observations notes to life. The perspectives of the participants were brought forth through the last cycle method of *value*. Each coding method allowed for those large chunks of information to be reorganized, and reanalyzed. The purpose of the coding was the discovery and emergence of “big picture” themes.

**Second cycle coding.** These themes were subjected to a deeper analysis in second round of coding (Miles et al., 2014). Three different coding methods were utilized in the second cycle, again aimed at reaching the saturation point for themes. The *narrative descriptive* coding method was applied to the emerged themes from the first cycle. It allowed for a deeper analysis and insight into the participants’ voices. The coding method of *patterns* was used in the analysis of the smaller chunks of data as well as with the smaller theme categories. With the second round of themes identified and at their saturation point, the *matrix* method was the last step in the second cycle. The *matrix* allowed for the visual presentation of the data, thus it allowed for visual groupings of themes to emerge.

**Trustworthiness**

The level of trustworthiness is often questioned when it comes to a qualitative study. Their resulted findings and conclusions are not measurable by hard numbers as that of a quantitative study. For this reason, qualitative researchers strive for a thoroughness and attention to details as they design their studies (Shenton, 2004). Researchers have varied options to consider as they develop a level of trustworthiness in the study (Bloomberg & Volpe, 2012; Guba & Lincoln, 1981; Shenton, 2004).

**Alignment.** This study’s trustworthiness is founded on the alignment of its research question and paradigm. It was the initial step toward establishing the study’s credibility. For a
study to achieve credibility, its research elements need to provide validity. Validity for this study was found in the collection of data from both primary and secondary sources. Interviews and observations were the methods used as primary sources of data. Various documents and their reviews served as secondary sources. These sources along with established protocols were contributors to the validity of the study. Member checking was also a contributor to the level of validity (Creswell, 2013). Although it is usually done on two sets of interviews, for this study it occurred on one. Each participant was presented with a transcribed copy of his or her interview to be verified. Mays and Pope (2000) advise researchers that member checking may cause issues with a study. On the other hand, Guba and Lincoln (1985) believe this action bolsters the credibility.

**Protocols.** Researchers build into a study certain procedures and protocols that guide the collection of data (Bloomberg & Volpe, 2012). This guide acts as a roadmap that can be followed, thus creating a level of dependability for a study’s findings. An interview protocol was established for this study to ensure that each participant was asked the same questions, in the same manner. Procedures were established for the proper handling of collected data and their storage. The established protocols and procedures used for this study were its roadmap. As a result of these methods, the study has a level of dependability (Bloomberg & Volpe, 2012; Shenton, 2004).

**Data collection.** The data collected for this study were rich in descriptive details from the interviews and observations. This fullness in context brought a level of transferability to the study. This means the findings were applicable to a similar situation on a broader scope. The protocols and procedures provided more to the study than a mere road map; they contributed to its confirmability. This road map provided a trail or a chain of evidence that can be audited
through interview transcripts and field notes (Bloomberg & Volpe, 2012; Creswell, 2013; Shenton, 2004). This chain of evidence assisted with the triangulation of the study.

Triangulation of a study can occur through its data methods or its data sources (Krefting, 1990). For this study, triangulation occurred through its methods of data collection. Those methods were interviews, observations, documents, and field notes.

**Potential threats.** There are potential threats when conducting a study that brings collected data and its analysis into question. These potential threats can wreak havoc on the validity of the study (Maxwell, 2013). When the data sources are considered compromised, this causes their analysis and conclusion to be placed into a similar position. This is one reason to ensure that the study’s various elements are in alignment with each other. The alignment of elements reduces the chances of one source being favored over another by the researcher (Bloomberg & Volpe, 2012). When the data sources and research elements are out of alignment, the findings may have a great importance than the theory itself. Yet, these situations are not the only possible threats to a study.

**Biases of the researcher.** The greatest threat lies within researchers and their own biases. Poggenpoel and Myburgh (2003) mention that this is the greatest threat to the trustworthiness of the study. These inner biases can infiltrate and influence the study at any juncture. How researchers monitor and handle those inner biases become their challenge throughout the course of the study. This researcher was overly aware of those biases and their potential threat to the study. Neutrality was a goal for this researcher while collecting data, which was ultimately more difficult than planned. The researcher’s previous apparel industry experiences were at the root of the difficulties. It was difficult as a former technical services and production manager not to
offer an opinion. It was equally difficult not to suggest reasons why a factory was experiencing an issue with achieving a desired result after four tries.

This researcher understood the importance of getting the information out to the mills and factories correctly the first time. As a factory floor supervisor, this researcher recalled a few times when a major sportswear company wanted a prototype constructed but a tech pack did not exist. When working with factories as a production manager, this researcher sought to supply them with ample information. Yet, these same experiences that allowed this researcher to connect with the participants in interviews and observations. The participants knew that this researcher had been in their position at one point in time and had come from a familiar background. To say these experiences did not pose potential threats or biases would be amiss; therefore, they are fully acknowledged and accepted by the researcher. It is through this recognition that their influences were dismissed.

**Role of the researcher.** The researcher’s role during the course of the study was an insider-researcher. This type of researcher possesses an understanding and knowledge of the setting (Unluer, 2012). This understanding and knowledge acts as a double-edged sword. On one hand, the understanding allows a researcher to quietly slip into the flow of the daily operations of the participants. Knowledge provides a background of how things work and supplements the understanding. The double edge is apparent when the researcher falls back into a comfort zone. The comfort zone can lull researchers into a false sense of awareness. They may forget to record an incident or assume the purpose of a document. With comfort and familiarity, there can be preconceptions and biases that find their way into field notes or interviews.
The researcher chose the setting with purpose, as it was familiar from her past experiences in the apparel industry. However, the researcher was now approaching it from a different perspective, one of knowledge. It was this perspective that prevented the false sense of awareness and slipping back into a comfort zone. The researcher’s background allowed her to focus on the knowledge aspect and its place in the development of the product. That same background provided the common ground that placed the participants at ease. This was due to the shared industry language between the participants and the researcher.

**Positionality Statement**

When asked about my career, I find myself asking, “Which one?” I have had several since leaving college. However, there are two careers that have defined me as an individual. They have both been in fashion, one as an educator and the other as a professional; they are inseparable. These inseparable careers have required the utilization of my knowledge, whether it was newly gained on the job or previously won. As an educator, I have shared my knowledge with students as they were guided toward the creation of new knowledge. As a fashion professional, my existing knowledge was transferred and applied to various positions, with new knowledge being created along the way. With the wearing of two hats, one for each career, I can see the practical application of knowledge creation and conversion in both the classroom and the industry.

Over the last eleven years, I have served as department chair for fashion design and merchandising programs at two different colleges. While at both colleges, I created and developed program curriculum, which mirrored necessary knowledge and skills in the apparel industry. As an instructor, I am able to bring my apparel industry experience and knowledge into
the classroom. Little did I think that those days spent on the production floor would eventually find their way into a classroom.

My career as an industry professional started on the production floor as a bundle handler. I cannot think of a better way to learn about a new field, than from the ground up. It was not entirely a new field, as both my Master and Bachelor of Science are in home economics. Home economics, when I was studying at California Polytechnic State University–San Luis Obispo (Cal Poly SLO) was a broad subject matter with numerous concentrations. I chose to pursue the clothing and textile concentration within the home economics major, as well as teacher’s education. The career in the apparel industry opened doors and new opportunities to transfer and apply my educational knowledge. It presented a new area in which to apply my academic studies.

Nonetheless, I entered Cal Poly SLO with the intention of teaching home economics at the junior and senior high level. My studies are the foundation of my educational career. My teaching experiences are quite diverse and span a wide age range. I have instructed home economics at the junior and senior high level, as well as substituting in various subject matters. I started my community college experience within two months of completing my master’s as an instructor for textiles. Later in that same year, I became a craft instructor for the college’s extension learning center.

I have experienced a rather semi-nomadic life as my family moved between the east and west coasts every three or four years. Most of my years were spent in California living in the Bay Area, more specifically Los Altos. Los Altos is an upper-middle-class neighborhood in Silicon Valley, once known for its orchards. I am a white female baby boomer, who grew up during the times of the Vietnam War, Flower Power and women’s liberation. I was in my
teenage years when these issues were top news, and they made a lasting impression on my persona. My solid work ethics stem from my Irish roots and Catholic upbringing. This combination has made me not afraid to roll up my shirtsleeves and get down to business.

The first time an industry outsider walks into a factory, there is a sense of being overwhelmed. The sheer noise, the hustle and bustle of the various areas of the floor can intimidate the best. When I accepted the job as bundle handler at an apparel manufacturing plant, I had no clue what it entailed. I never imagined that my first day would be to report to a warehouse storage unit.

The position of bundle handler is far from being glamorous as it lies at the bottom of the organizational structure in a factory. A bundle handler’s responsibility is to move the bundles of cut garment pieces through the factory floor, from operator to operator. I would physically pick up the bundles from a cardboard box that had been placed in front of each operator. As each operator’s cardboard box filled with partially sewn garments, I would then move the bundles again to the next sewing operation. These bundles followed a specific path based on construction sequences as listed on the bundle ticket.

Each sewing operator was responsible for a single task in the construction of the garment. Sewing operators were paid by the piece, which meant each operation had a specific pay rate assigned to it. I would receive searing glares from operators when I failed to provide them with ample work in a timely and quick manner. These searing glares were well-deserved at times, as I was directly affecting their paycheck.

A formal education in clothing and textiles, along with years of personal sewing experience, did not prepare me for the job a bundle handler. I knew how garments were symbols as I have been selling since I was 12 years old. However, mass production assembly is not at all
close to that of home sewing. It is faster, and each operator is responsible for a single sewing operation such as closing the side seams or attaching the sleeves. The entire mass production assembly experience was far beyond what was ever discussed or taught in clothing construction classes at Cal Poly SLO.

At college, my classes focused on understanding the nuances of clothing construction and its translation into future class lessons. As a student, I was taught to critically evaluate and analyze fabrics, and create clothing patterns. We were also taught how to properly evaluate the fit of a garment and understand unit construction of the garment. The unit construction of a garment is the sewing and completion of that garment through designated sections. One would complete the sewing operations for the front and back of a blouse (e.g. darts and pockets) before attaching the front and back pieces to each other at the shoulder seams.

Even with a formal education and years of home sewing, I still needed to prove myself to the sewing operators and the factory owner. I had to earn their acceptance and respect to become an apparel insider. As a bundle handler, I needed to assure the operators on the factory floor that they would experience as little downtime as possible. Just the simple act of having spools of thread sitting on top of the next piece allowed operators to experience less downtime. As time went on, I learned how to thread each machine and its seam construction. This would come in handy at a later time, since I would be called upon to instruct the sample sewing operators in garment construction.

Within a few months, I was promoted to floor supervisor. In this position, I was able to increase the productivity of the floor by 100% within two months. The increased floor productivity was a result of combining my new knowledge of the production floor with my existing knowledge of garment construction. With my success on the factory floor, I had earned
the right to be called an apparel insider. As my industry career progressed, I continued to combine existing knowledge with new knowledge at each position. To this day, I am still considered an apparel professional within the industry, the one who cut her teeth on the factory floor.

**Summary**

The preceding sections of the chapter provided an explanation and a plan for how the study explored knowledge creation and conversion processes. Each section explained the protocols and documentation that were used by the researcher in the collection of data. The procedures in these sections yielded findings that addressed the purpose of the study and answer its question.

The purpose of this study was to explore the knowledge creation and conversion within an apparel company as it developed a product line for market. The exploration sought an answer to the research question: How does a small U.S. apparel company engage in the knowledge creation and conversion processes as it develops a product line for market?
Chapter 4: Findings and Analysis

Introduction

The question that has guided this research is: How does a small US apparel company engage in the knowledge creation and conversion process as it develops a product line for market? In the quest to discover answers to the research question a combination of interviews and observations was the primary source of findings. This in turn led to the collection of two secondary sources in documentation and product samples. The selection of these various types of findings provided additional avenues of exploration. Three themes have emerged from the analysis of these findings: (a) artifacts of the new product development (NPD) process, (b) knowledge intensive activities, and (c) passive sharing of knowledge. As these themes are explored in deeper detail, their connection and relationship to the research question is explained in the context of knowledge creation and conversion. The following sections are the analysis of the emerged themes presented in a narrative format.

Theme One—Artifacts of the NPD process

The NPD process has several artifacts that are central to the creation and conversion of knowledge. NPD artifacts are considered explicit knowledge and existed in such forms of product samples, technical flats, and technical packets. The usage of the artifact and for what purpose was determined by the participant’s activation of its knowledge. This knowledge contained within an artifact exists in an activated and stored state. When the NPD artifact is used for the current season, its explicit knowledge is considered activated. NPD artifacts that are out of season or part of the archival library, their knowledge is considered as being stored. The following section demonstrates and provides support of theme one—activation of NPD artifacts within an apparel company (see Table 5).
### Table 5

#### Listing of Artifacts Examples in New Product Development Process

<table>
<thead>
<tr>
<th>Examples of Artifacts</th>
<th>Purpose</th>
<th>Activated by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design samples</td>
<td>Development of a new style</td>
<td>Suzie</td>
</tr>
<tr>
<td></td>
<td>Reflects a growing trend</td>
<td>Suzie</td>
</tr>
<tr>
<td></td>
<td>Evaluation of a new style</td>
<td>Annie</td>
</tr>
<tr>
<td>Prototype samples</td>
<td>Development of a style</td>
<td>Annie</td>
</tr>
<tr>
<td></td>
<td>Evaluation of fit, style and proportion</td>
<td></td>
</tr>
<tr>
<td>Salesman samples</td>
<td>Physical representation of the entire seasonal line</td>
<td>Suzie and Mary</td>
</tr>
<tr>
<td>Size set samples</td>
<td>Evaluation of construction and quality</td>
<td>Annie and Mary</td>
</tr>
<tr>
<td>Sample cards</td>
<td>Method of distinguishing the different types of product samples</td>
<td>Mary</td>
</tr>
<tr>
<td>Line sheets</td>
<td>Visual presentation of potential products for the year</td>
<td>Suzie</td>
</tr>
<tr>
<td>Technical flats</td>
<td>Used within technical packets</td>
<td>Annie and Mary</td>
</tr>
<tr>
<td>Technical packets</td>
<td>Provides specific detail on the product and used for it manufacturing</td>
<td>Annie and Mary</td>
</tr>
<tr>
<td>Fabric and trim binders</td>
<td>Used in the evaluation of submitted fabric lab dips from factories, mills and vendors</td>
<td>Mary</td>
</tr>
<tr>
<td>Time action calendar</td>
<td>List the deadlines important to developing fabric and products</td>
<td>VP of production</td>
</tr>
</tbody>
</table>

**Product samples.** A product sample is a physical representation of a product. Samples exist as a form of stored explicit knowledge that is activated into current explicit knowledge when referenced by an individual. Several types of product samples were found to exist within the product development workspace at Company C. The participants provided the definition for each sample type.

**Types of product samples.** *Design samples* are samples that provide a designer with inspiration or confirm a growing trend (see Table 5). These are products that have been purchased to be used as a source of reference for styling, fabric, or color. A *prototype* is the first physically constructed sample of a potential product. This potential product is created by the
factory and is made in a single sample size such as a medium or large (see Table 5). The sample’s purpose is used to determine the styling and fit of the initial product concept. Prototypes can also be used as a preliminary evaluation of the factory’s construction quality. Simply because a particular factory submits a prototype it does not ensure that it will receive production.

*A salesman sample* is a product that is an example of what is offered for the current season. These samples reflect the entire line of products available for market and are utilized for photo shoots, trade shows, or sales meeting presentations (see Table 5). As these samples are representative of the entire line; they exist in every color or print. *Size sets* are samples that a factory has constructed in the full size range. This size range would match the size offerings of the product such as an extra small through an extra-extra large. The completion of a full size range allows for the evaluation of each size in terms of fit and proportion. These samples have a dual purpose as they are used to evaluate a factory’s construction of the product along with its quality (see Table 5).

*Product sample cards.* These various sample NPD artifacts express explicit knowledge through a physical and tactile method. *Sample cards* are attached to each sample in an effort to distinguish them. The color of these cards denotes the type of product sample (see Table 5). A *red card* is attached to a product sample when it is used for quality control purposes.

Factories submit this type of product quality samples. Once Annie approves these samples, the factory starts production. Her notes and the approval date are noted on the card as well as the product style number and the factory. A *product style number* is a numbering and lettering system that a company utilizes to denote a product. A style number reflects the group that the product belongs to (men’s, women’s, or youth) and the season. When a *white card is*
attached to a sample, this product is under development. The white card holds information regarding the product style number, the factory name, and date of submittal. Comments are also noted on the card in regard to any issues that were noted during its evaluation.

**Product samples and explicit knowledge.** Knowledge that is explicit existed in various product samples that were utilized by the participants. Whether the product was from the current line or one pulled from the archives, its explicit knowledge was activated when used by a participant. It is important that the participant voices be heard regarding the various forms of explicit knowledge and its activation. Below are excerpts from participant interviews as they explain the usage of the product samples listed in Table 5.

**Suzie.** Suzie talked about how she used purchased product samples (design samples—see Table 5), as a way to convince the owner there was a trend. Suzie did mention that the owner is open to new products. When Susie is promoting an idea and the owner is not in agreement with her, she goes shopping. Suzie said, “I buy [design] samples for design inspiration, and research design trends.” Suzie said,

I will go to every store that I know and I’ll buy that same product to show him. Look, it is everywhere and that it is a trend we need to pay attention. Not fast fashion, but a trend that has been verified as being tried and true.

Besides using the product (design) sample in the determination of trends, Suzie mentioned,

I buy a lot of [design] samples to see what our competition is doing. I have a sample budget. Annie and I will look at them and figure out how our products should be constructed. Do we choose to use a double needle or a coverstitch? Annie is better at that, so whatever she decides is fine. I always have reference samples for Jamie and Fred to send to the factories.
**Annie.** Product samples for Annie served multiple purposes throughout the product development process from prototypes to size set (see Table 5). She is responsible for requesting and evaluating the samples from the factories. Annie mentioned,

If we don’t like the prototype, we get another, and another one and another one and another one, until we get the one we want. Then we put it on the rack and then we present it. They [the other members of the product development department] don’t realize how much money they are wasting. They don’t think they [the other members of the product development department] pay for the samples and prototypes. They pay for the prototypes, but they don’t think they pay.

**Mary.** Mary has the daunting task of trying to keep over 200 various product samples (see Table 5) in some type of organization. Mary stated,

These samples are like gold and they need to stay in place. I make sure they’re [samples] all in the correct place. So if anybody needs to go looking for something, it [the sample] is in the right place. People have tried to walk away from them at times. Annie and I are very protective of them.

**Summary.** Explicit knowledge is expressed in such items as documents and manuals which allow their knowledge to be easily shared with others. In Company C, the product samples represent one type of NPD artifact that expresses explicit knowledge. Suzie activated the explicit knowledge of a product sample with the owner as she shared what was trending in retail stores. Annie activated the explicit knowledge in product samples during her evaluations. This same explicit knowledge was activated when Mary assisted with the evaluations. Mary’s own words emphasized the importance that the samples have in the product development processes.
Her comment on how she and Annie are protective of the samples highlighted the importance of explicit knowledge.

**Line sheets.** A *line sheet* is a visual presentation of product tech flats that may or may not be offered in the line for the year (see Table 5). A technical flat or tech flat is a detailed computer rendering of the product and is discussed in greater detail in the section below (see Table 5). The line sheet and its product tech flats are Suzie’s expression of her tacit knowledge as it is converted into explicit knowledge. Suzie uses the line sheet (explicit knowledge) as a visual support as she verbally (tacit knowledge) expresses her envisions of an upcoming product line. As time passes, the line sheet (explicit knowledge) experiences changes as product are added or deleted on the basis of the owner’s opinion (tacit knowledge). The line sheet is generated from the tech flats that are completed with stitches and closure details by Annie and Mary.

**Technical flats.** Explicit knowledge not only exists as a physical object but as a visual image. Visual images such as technical flats are sources of explicit knowledge for Company C (see Table 5). A *technical flat* is a computer illustrated rendering of the product that shows the views of the front and back. The *technical* part of the flat refers to details that are visible in the rendering such as stitching lines, pocket openings, or closures. *Closures* are the manner in which the product stays closed through the usage of zippers, buttons, or snaps.

Suzie first creates the visual appearance of the product as a flat. She mentioned that when she does “sketch [computer illustration] it out [the product] and, and even if I don't sketch [computer illustration] it all up, I'll have Mary sketch it out [the product].” According to Annie, those flats that Suzie shares with Mary are incomplete. Annie mentioned that
Most of our job is spent re-sketching [computer illustration] because the first sketches [computer illustration] we get are just thumbnails, and then once things are finalized, then we do the final sketches [computer illustration], and drop in all the color, throw out the fabrics, and everything is set up the CAD [computer aided design software—Adobe Illustrator].

In regard to the completion of the flats, Mary added, “I usually end up completing the flats for Suzie. She only gives me a rough sketch [computer illustration]. In addition, if there are changes, I will do that too.”

**Technical packets.** Explicit knowledge exists within manuals or technical packets (tech packs), as these are artifacts that can be easily shared with other individuals (see Table 5). To use an analogy, a *technical packet* is thought of as a *how-to-assemble* manual for an apparel product. A *technical packet* contains all the knowledge needed to construct and evaluate a product and is a source of explicit knowledge for participants at Company C. Various pieces of specific information are compiled as the tech pack (short for technical packet) is created. Some pieces of information included in a technical packet are the description of the product and its fabric, the colors it was made in, and care instructions. Company’s C tech packs includes the following pages:

- **Product header.** This appears on the top of each page in the tech pack. The header includes: (1) style number; (2) description of product; (3) vendor (who is constructing the product); (4) size breakout (what sizes the product is offered in); (5) sample size (the size being used for fitting); (6) sample status (where it is in development); (7) date (when product first developed); (8) the year; (9) fabric
(what type is being used); (10) supplier; and (11) content (refers to the content of the fabric).

- **Technical flat.** This is on the cover sheet for the tech pack. There is a space below the header where a technical flat is placed. At the top of the page is a header which contains explicit knowledge about the style.

- **Graded spec (specification).** A graded specification sheet reflects how the measurements decrease or increase per size. It states the POM (points of measurements) which are used as reference points in the evaluation of a garment. The factory also uses these measurements as they develop the pattern for the product. What POMs (points of measurements) are on this page depends on the type of product. Several of the tech packs that were reviewed had multiple graded spec sheets. Each reflected changes in the measurements based on fitting sessions and Annie’s comments.

- **Fabric and trims.** This page has three sections containing explicit knowledge. One section is for the fabric or fabrics that are used within the garment. The explicit knowledge is specific for each fabric or fabrics. It lists the fabric manufacturer (vendor), fabric name, and description, such as 8-ounce single knit jersey. Also listed are the colors or prints of the product. This specific explicit knowledge allows the factory to locate the correct fabric rolls in their plant. A second section is for the trims and other items that are used in the construction of the product. The type of trims listed is dependent of the product. Possible trims would include zippers, toggles, shock cords, and eyelets. The last section displays images of Company C’s main label, hangtags, and a zipper pull.
• **Additional pages.** These differ with each product and are reflective of changes that occurred while in development. One product had a technical flat of the hood reflecting measurement changes in the width and length. These additional pages present visual clarification of the changes. Images also allow for “compare and contrast” when issues were encountered with the construction of samples.

**Summary.** Explicit knowledge is contained within a product’s technical flat (tech flat) and the products technical packet (tech pack); both are examples of NPD artifacts. For example, the technical flat is explicit knowledge expressed in a computer rendering of the product (see Table 5). This includes a front and back view of the product. This flat is placed into the product technical packet. Explicit knowledge is contained in the visual imagery of a product’s technical flat. A technical packet is basically a how-to manual for the development of a product (see Table 5). Within the pages of a technical packet are pieces of knowledge that Annie and Mary collected from other participants (see Table 5). Annie said, “I try to throw a tech pack together as quickly as I can. Mary will gather information, I will gather information, and we share it with each other.” Those pieces of knowledge are now assembled into a product’s technical packet. This explicit knowledge is updated each time the product experiences a revision due to fitting sessions or quality issues.

**Fabric and trim binders.** Fabric and trim binders contain explicit knowledge that exists within a stored state (see Table 5). A stored state is explicit knowledge that is not being used, thus has not been activated by an individual. When Mary was not busy maintaining some type of order to the 200 product samples (see Table 5), she brought the same order to the fabric and trim binders. At first glance, there appeared to be as many binders as there were various product
samples. There were over 40 binders residing on the shelving in Mary’s and Annie’s workroom. Mary explained,

There are two series of binders and they are divided by development and production. The binders are marked according to the responsible mill or factory and the product style. We have development books, and then once the style is into production, there is bulk fabric going on, that's when I create a binder for each fabric that we have. There are also binders for the trims.

The fabric binders contain various color swatches (explicit knowledge) submitted by factories or mills. These vendors are required to submit lab or a yarn dip swatches (explicit knowledge) each time the product is slated for production. A lab dip is a swatch of woven fabric that needs to match an established color standard (explicit knowledge), whereas a yarn dip is a swatch of knit fabric that also needs to match the established color standard (explicit knowledge). These various dips result from a factory or mill’s attempt to match the requested color standard (explicit knowledge). This company refers to a trim as buttons, snaps, labels, shock cords, hangtags, and zipper pulls. These types of items had established color (explicit knowledge) or appearance (explicit knowledge) such as a company logo label.

**Time action calendar.** A time action calendar is a to do task list noting deadlines as well as the responsible person for each assigned task (see Table 5). Deadlines are established to reflect the dates of trades shows, sales meetings, and delivery dates. Although the deadlines do not change, the status of the to do tasks do as they are completed or remain active. The various tasks and deadlines are pieces of information organized by the VP of product development as she created new explicit knowledge.
The VP of production not only establishes but also updates the calendar to reflect any changes in deadlines or completion of tasks (see Table 5). Annie stated, “The VP controls the calendar, but even more so the owner controls the calendar. If he isn’t ready for a line presentation, it will be delayed and rescheduled later.” Annie also mentioned, “I will add my own deadlines to the calendar, so I can keep track of my items.” At the meeting, Annie took notes on the new status of the other participants’ to do items as they shared their updates. Annie used her meeting notes to update her calendar that she shared with Mary. Her actions along with the other participants caused the calendar to reflect both new and existing knowledge.

**Summary.** This section and its presentation of collected findings provided the support for the theme—activation of NPD artifacts. NPD artifacts were central and played an important role throughout the product development process at Company C. These artifacts included various types of product samples, technical flats, and packets along with fabric and trim binders (see Table 5). In the findings, explicit knowledge existed in two states, activated or stored. When a participant was working with one of the artifact examples, they activated its contained explicit knowledge (see Table 6). Conversely, when those same artifacts were not referenced or in use by a participant, the explicit knowledge was in a stored state. Hence, from these findings, the activation of NPD artifacts has an important role in the creation and conversion of knowledge during the product development process for Company C.
Table 6

**Summary of NDP Artifacts, and Participant’s Comments**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Participant</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design samples</td>
<td>Suzie—designer</td>
<td>“I buy samples for design inspiration, go to fabric trade show and research design trends.”</td>
</tr>
<tr>
<td>Prototype samples</td>
<td>Annie—director of product development</td>
<td>“If we don’t like the prototype, we get another, and another one and another one and another one, until we get the one we want.”</td>
</tr>
<tr>
<td>All product sample types</td>
<td>Mary—technical designer</td>
<td>“I get lots and lots of samples. Usually each color and each size, so I review all of them. Annie and I are very protective of them.”</td>
</tr>
<tr>
<td>Technical flats</td>
<td>Annie</td>
<td>“Most of our job is spend re-sketching because the first sketches we get are just thumbnails, and then once things are finalized, then we do the final sketches, and drop in all the color, throw out the fabrics, and everything is set up the CAD.”</td>
</tr>
<tr>
<td>Technical flats</td>
<td>Mary</td>
<td>“I usually end up completing the flats for Suzie. She only gives me a rough sketch. In addition, if there are changes, I will do that too.”</td>
</tr>
<tr>
<td>Line sheets</td>
<td>Annie</td>
<td>“Everything is set up in CAD, so we can drop them right into the line sheet.”</td>
</tr>
<tr>
<td>Technical packets</td>
<td>Annie and Mary</td>
<td>“I try to throw a tech pack together as quickly as I can. Mary will gather information, I will gather information, and we share it with each other.”</td>
</tr>
<tr>
<td>Fabric and trim binders</td>
<td>Mary</td>
<td>“We have development books, and then once the style is into production, there is bulk fabric going on, that’s when I create a binder for each fabric that we have. There are also binders for the trims.”</td>
</tr>
<tr>
<td>Time action calendar</td>
<td>VP of production</td>
<td>“The VP controls the calendar, but even more so the owner controls the calendar. If he isn’t ready for a line presentation, it will be delayed and rescheduled later.” - Annie</td>
</tr>
</tbody>
</table>

**Theme Two—Knowledge Intensive Activities**

One way to describe the product development process is to consider it as a composite of knowledge intensive activities. These intensive activities propel the product through its developmental phases and are dependent on knowledge. Within each of these knowledge intensive activities, knowledge is used and can be created or converted. Within these product
development phases, knowledge exists both as tacit and explicit. Tacit knowledge resides within an individual, thus it is difficult to express. On the other hand, explicit knowledge is easily expressed through documents and product samples. The degree to which knowledge was depended on and used by the participants is discussed in the following section (see Table 7).

Table 7

*Listing of Knowledge Intensive Activities*

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Participant/s</th>
<th>Knowledge activated</th>
<th>Knowledge created / converted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit session &amp; samples</td>
<td>Annie</td>
<td>Activated tacit &amp; explicit</td>
<td>Tacit—created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Explicit—created</td>
</tr>
<tr>
<td>Evaluation of lab dips</td>
<td>Mary</td>
<td>Activated tacit</td>
<td>Tacit—created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td>Explicit—created</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated explicit</td>
<td></td>
</tr>
<tr>
<td>Development of a new style</td>
<td>Annie</td>
<td>Activated tacit</td>
<td>Tacit—created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td>Explicit—created &amp; converted</td>
</tr>
<tr>
<td>Fit for the new style</td>
<td>Annie</td>
<td>Activated tacit</td>
<td>Tacit—created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td></td>
</tr>
<tr>
<td>Color name for a new style</td>
<td>The group</td>
<td>Activated tacit</td>
<td>Tacit —created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated explicit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td></td>
</tr>
<tr>
<td>Jacket neck opening</td>
<td>Annie and Mary</td>
<td>Activated tacit</td>
<td>Tacit—created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated explicit</td>
<td>Explicit—created</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td></td>
</tr>
<tr>
<td>Missing snaps</td>
<td>Jamie and Annie</td>
<td>Activated tacit</td>
<td>Tacit—created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td></td>
</tr>
<tr>
<td>Discoloration of jacket</td>
<td>Jamie and Annie</td>
<td>Activated tacit</td>
<td>Tacit – created &amp; converted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activated stored explicit</td>
<td></td>
</tr>
</tbody>
</table>

**Fit sessions and samples.** As previously mentioned, a *prototype* is the first physical construction of a product made by a factory. The prototype represents the factory’s understanding of the explicit knowledge expressed through the sample’s corresponding tech pack. With each submittal of the prototype, Annie conducted a knowledge intensive activity called a *fit session* and evaluated the construction of the prototype (see Table 7). A fit session is a
knowledge intensive activity that uses both tacit and explicit knowledge. The tacit knowledge resides in Annie and is an accumulation of previous fitting experiences. A second purpose of a fit session is to evaluate visually the product’s fit on a live model. At this point, Annie is activating her tacit knowledge regarding fit as it compares to the fit of the sample. While Annie conducts her evaluation, she is comparing her tacit knowledge to the explicit knowledge of the sample. It is through this activity and her comparison that Annie creates new tacit knowledge. The third purpose was the visual evaluation of the product’s overall appearance and specific appearance points. An example of a specific appearance point of interest would be the size of a pocket relative to the size of a shirt and its placement or location on the shirt. When asked about fitting sessions Annie mentioned,

I am currently updating the fit of the products as they have a boxy look. So I am trying to narrow them down a bit so they will have a more relaxed fit and slimmer appearance. I’m trying to push so hard to get these samples fit, so I get decent size sets.

Mary worked closely with Annie and when asked about fitting sessions she said,

I help Annie in the fitting sessions because even though she is the one that sends out comments to the factories. I have to be aware of what's going on in case she's out, so I can send the comments. If she's [Annie] not here what needs to be measured, I can measure the garment.

With over 120 products in the line, it followed that Suzie did not participate in every fit session. According to Annie,

Suzie is at our fits sessions at the start, so we can solidify the design is what she has envisioned [relative to overall appearance]. Once she approves the design, I order the set. Mary and I fit all the way through from prototype to size set.
A *fit session* also occurred when size set samples were received from the factories. With these sessions, the fit was evaluated for all of the samples in the size range. Sizing may affect fit as the pattern is adjusted for dimensional change across the sizes.

**Evaluation of fabric lab dips.** In her job, Mary conducts a number of knowledge intensive activities using her tacit knowledge and the stored explicit knowledge in technical packets and reference binders. In one of these activities on almost a daily basis, she evaluates fabric lab dips submitted by either a factory or a mill (see Table 7). A fabric lab dip is a piece of fabric dyed to a specific color that occurs prior to the production of fabric. These submitted fabric lab dips represent explicit knowledge of the requested color by the factory or mill. The evaluation of a fabric lab dip is a knowledge intensive activity for Mary.

Mary activates her tacit knowledge on color when using a light box to determine whether the fabric lab dip (explicit knowledge) matches the established color standard. “I have set up certain settings that match the lighting conditions for each vendor. This way we are looking at the lab dips under the same lighting conditions,” said Mary.

**A new style.** Prior to Suzie’s leaving for vacation, Annie and she had a conversation about the development of a new style, another knowledge intensive activity (see Table 7). According to Annie, Suzie wanted her to develop a new style with a unisex fit. A *unisex* fit refers to an apparel product that was worn by both men and women. Annie was not given much information on how to create this style and fit, merely being instructed to blend a men’s top with the women’s version.

I don’t know what she was thinking! You just can’t tell the factory, “Oh, by the way, can you combine these two styles for me?” You have to give the factory a tech pack or you’ll never know what you will get.
Development of the new style. The lack of a sketch compounded by limited information did not provide Annie enough knowledge to address the new style activity. Annie had no choice; she used her knowledge capabilities and experiences in product development as the starting point in the creation of the new style (see Table 7). For the first step, Annie needed to develop a tech packet (technical packet) for the new style using her tacit knowledge of styling and construction. Annie knew that the explicit knowledge contained within the tech pack would assist the factory in constructing a prototype of the new style. She hoped that once the prototype was received from the factory that it might match what Suzie had envisioned for a new style.

Using stored explicit knowledge from a similar men’s and women’s top, Annie needed to develop finished measurements for the new style (see Table 7). Finished measurements on a product sample referred to such points of measure (POM) as the length of a sleeve or the width of the chest. It was this stored explicit knowledge Annie activated as she compared the physical features of the two similar tops. Yet, only so much explicit knowledge is supplied by a product sample. The remaining stored explicit knowledge related to the construction and the trims used in the tops needed to be activated from their technical packets. With the men’s and women’s tops in hand along with their corresponding technical packets, Annie had enough explicit knowledge in order to create and develop a new style. Annie mentioned before starting, “I found out when I got here that our unisex fit is based on our men’s fit. So, we really don’t have a unisex fit. So, I am going to have to come up with something.”

With various pieces of explicit knowledge in hand, Annie physically started working with the pulled men’s and women’s tops. She determined that because the new style was a blend of both men’s and women’s, it made sense to place the women’s sample on top of the men’s sample. This activity gave her a visual comparison of the explicit knowledge differences between the two
at a quick glance. Now, Annie determined and created the measurements for the new style, thereby creating new knowledge. Using a tape measure, Annie determined the approximate length of the style: “We won’t know anything until we can see a physical sample.” This process for each POM (point of measure) continued until Annie had completed the measurement sheet. The new measurement sheet and its newly created explicit knowledge would become part of the tech pack’s explicit knowledge, which would be later shared with the factory.

Factories need more than numbers in a tech pack to construct a new style; they need images such as a technical flat. There was a reason why Annie created tech flats using CAD software, as their stored explicit knowledge could be accessed and activated quickly. Just as Annie compared the explicit knowledge of the two physical style samples, she did the same comparison of explicit knowledge with the tech flats. In developing the new design, Annie created new knowledge by using the explicit knowledge in both the samples and the existing tech flats.

**Fit for the new style.** At the department meeting, Annie updated everyone on how she had developed the new style. She mentioned, “By utilizing similar tops from the men’s and women’s line, I was able to determine some preliminary finished measurements.” She also advised the group that until a physical sample was received from the factory, she had no way of verifying the fit (see Table 7). After lunch, the VP of production approached Annie regarding the development of the new style. “Annie, could you show me how you came up with the new style look and measurements?” said the VP.

Annie proceeded to explain and demonstrate to the VP of production how she went about it. “Suzie wanted a unisex fit, so I gave it the same shape as the other two but brought in the sides about 1½” on each side,” said Annie. Annie found the two samples and laid them on the
floor in front of the VP. Annie demonstrated with her measuring tape how each of the finished measurements was determined. Annie noted, “The slope (angle) of the shoulder is less, the shoulder length is about ½” less and the underarm curve is not as deep.” Annie motioned with her hand and drew an imaginary line, which reflected the shape of the new style. The VP agreed with Annie that until a style came in, they would just have to wait and see. She told Annie, “I hope there is time to fully develop the style before the deadline.”

In this knowledge intensive activity, Annie using her new tacit and explicit knowledge of the new style proceeded to share with the VP of production. Although Annie had expressed it in the meeting, she was only able to share her tacit knowledge on how she achieved the fit of the new style. This was the main reason the VP of production had stopped by Annie’s workspace seeking clarification of Annie’s knowledge intensive activity. Annie’s demonstration of measuring the samples and the motion of her hands was the conversion of tacit knowledge into explicit knowledge.

**Color name for a new style.** The VP asked Mary during their weekly meeting to give the group an update on her task relative to the color for the new style (see Table 7). Mary noted, “Suzie had left a color chip, swatch, and style number on my desk. I have already sent it to the factory, so a sample could be dyed and knitted up.” The VP requested that Mary bring the color chip and show it to the group. She retrieved the color chip as well as the fabric binder for the mill. Both the color chip and the fabric binder are examples of explicit knowledge. Everyone huddled closer to see the chip and the fabric swatch. Mary found the color standard for oatmeal and laid the color chip next to it. The group began visually comparing the color chip and the fabric swatch. The dialog that ensued demonstrates how the participants used knowledge stored in the samples and their tacit knowledge from previous experiences to create new knowledge.
The ensuing dialog along with the physical comparison of the two colors were knowledge intensive activity at the group level. The group activated their tacit knowledge of previously used color names during the comparison of the color chip with the color standard.

Jamie said, “This isn’t our oatmeal, we already have one. We can’t have two different oatmeals. It would cause problems with sales and confuse clients. What about heather grey?”

Mary looked through the fabric binder and found the heather grey swatch. The VP said, “No, that’s not it.”

Jamie said, “What if we called it heather oatmeal?”

“No, it is still too close to oatmeal and it will still confuse sales.” The VP continued, Let’s just call it sandstone until Suzie gets back from vacation. We should still have time to change the color name. Mary, please immediately notify the mill and see if the changes can be made. Let’s hope they haven’t started knitting yet.

Fabric lab dips (matching fabric submits to established color standards) were included in Mary’s long list of knowledge intensive activities. She automatically had the knowledge of what steps to take with the color chip by activating her tacit knowledge. She sent the chip color number to the vendor who would be responsible for the lab dip. At the bottom of the color chip is a pantone color number; this provides a starting point when talking colors with a vendor. Pantone is a color company that establishes yearly color offerings. These color numbers are used between vendors and companies to assist in achieving a desired color. The color number listed under each color was a standardized number created in the Pantone color system.

Jacket neck opening. In another example of knowledge intensive activities, Annie remarked that having to address a factory prototype sample (NPD artifact) first thing in the morning was not always the best way to start a day. Nevertheless, there was a jacket prototype
waiting for Annie on her desk. As Annie picked up the jacket and placed it on the worktable, she commented, “This is the fifth attempt with working with the factory to correct an issue with the neck opening.” Later in the day, Annie printed out the jacket’s corresponding tech pack and started the evaluation on the neck opening (see Table 7).

Using her tacit knowledge, Annie started by visually evaluating the jacket (activating explicit knowledge) for any clues that might point to other possible construction issues. The factory in the past had applied an outer seam tape at the shoulder seam and it had roped (twisted). Annie wanted to double check that the tape was now lying flat. Unfortunately, the factory still had the grain line wrong on the seam tape. The word grain line refers to the direction of the fabric yarns. The prototype sample still showed the seam tape roping, so Annie called over Mary and had her bring the magnifier. Annie made the comment, “Look at this grain line, does it look like it is on the bias to you?” Mary proceeded to examine the seam tape under the magnifier and replied that it did not. Annie said, “I told the factory that it was not on the bias. They keep insisting that it is. But clearly it’s not.” Their discussion used their tacit knowledge of fabric and technical flats as they created new knowledge regarding the results of the prototype.

In addition, they used the stored explicit knowledge in a specific brown jacket design sample that Annie retrieved from the numerous samples in the workspace. Annie placed the brown jacket design sample next to the prototype jacket and at first glance, the difference between the two was in the number of seams that were taped:

They used this as a knock-off (referring to the brown jacket) to create their first sample and the seam tape grain line was right. Since then, they can’t get it right again. They are making the same mistake, over and over again. I keep making the same comments, over and over again.
Unsatisfied with the continuing issue of the roping seam tape, Annie proceeded to return her focus to the neck opening. She immediately noticed another issue and shook her head. Annie mentioned to Mary, “We have other things that are more important right now. We will relook at this again tomorrow.”

The next day, after getting herself settled in at the desk, Annie started the evaluation of the jacket again. This time she focused strictly on the neck opening issue. In doing this she was focusing on the issue that the factory had created in their latest sample. Annie used the explicit knowledge contained in the jacket along with her observations and other skills as new knowledge was created and converted. From this newly created tacit knowledge, Annie continued with her visual evaluation of the jacket neck opening. Immediately, she noticed there was a twisting at the shoulder panel on the jacket. A shoulder panel in reference to this jacket was a piece of fabric that straddled the shoulder area of the jacket from front to back. While one shoulder lay flat, the other dropped and had a slight twist to it. Now, there was another issue for Annie to address with the factory, but first she would need to determine what caused it.

Grabbing two rulers and paper, Annie had Mary join her at the worktable to take advantage of the jacket issues as a learning moment. This learning moment would create new tacit knowledge for Mary as Annie demonstrated how to evaluate the drop of a neck opening (explicit knowledge). The rulers provided Annie straight lines of reference as she evaluated the drop of the neck opening. The drop refers to the difference between the center front and center back neck opening. When made according to the tech pack for the style, a neck opening at center front is lower than the back. How much lower is determined by the shape of the neckline and the developer, according to Annie. She explained this explicit knowledge to Mary as she
lined up the rulers with the center back and at the joint of the shoulder to armhole seam. Annie said to Mary,

I want to show you how to measure the drop of a neck opening. You can see that the back neckline is almost at the same height of the front neckline. There should at least be a $\frac{1}{2}$” difference between the two. I stated in an email to them two weeks ago and they still have not corrected the problem. Let’s check the other measurements. It looks like I will have to explain it again to them. I don’t know how many times it will take them to get it right.

As Annie made her notes, she converted her tacit knowledge of neck drop into new created explicit knowledge for the factory. Once the tech pack was updated, it was attached to an email and sent to the factory.

**The missing snaps.** This knowledge intensive activity example is different from the previous ones as it occurred at the conclusion of production, prior to the completed products’ being shipped out to Company C. Jamie, the woven production manager, approached Mary and Annie with several images (explicit knowledge) of a completed top that was missing snaps (see Table 7). The defective product was brought to her attention by her finishing factory. A finishing factory is a vendor that offers packaging and shipment of completed products. Jamie asked both Mary and Annie how this could have happened. As they looked at the top, the VP approached them and joined in the conversation. The VP asked Jamie, “What happened? Where is this top and who discovered the issue?” The VP posed questions that were relevant to the situation and wanted viable answers from the other participants. This example is how an issue at a factory ripples back to the home office for a solution. Participants needed to activate their tacit knowledge in order to solve issues.
Jamie replied, “The finisher (someone who packs the finished products for shipment) discovered it as they were packing up the units for shipment. But look, only one snap is missing out of the three and it is the bottom portion of the snap.”

The VP of Production asked Jamie, “Did you not have the finished goods checked for quality?”

Jamie replied, “Yes, I did. But these units are from the finishers and not the factory.” As they continued to look at the top, Mary pulled the quality sample (explicit knowledge) from the rack and used it for reference.

Annie said, “The snap cap is in place, but it is missing the bottom piece.” The group expressed their concerns on how the top made it past quality control with snaps partially missing. They asked each other the question in dismay, “Did they (the factory) not check if the snaps functioned?” Their discussion quickly switched from what caused the defective snap, to that of how and how quickly the issue was going to be resolved.

The VP asked Jamie, “Do you think the finisher could repair them for us?”

“I don’t know, I could ask. It would be more cost effective, if they made the repairs, as we don’t have the equipment to do that,” stated Jamie.

The VP asked, “Does the finisher even have the parts to make the repairs?”

Jamie said, “I can have the parts sent to them.”

The VP stated, “There is no way for us to make the repairs here. It would be better to have the finisher do it.” As a group, they could not understand how the factory did not notice the missing snaps. The VP expressed, “My concern now is how many units have been affected.”
Within this example, participants shared their tacit knowledge as they worked a solution for the missing snaps. Besides the sharing of tacit knowledge, new knowledge was being created and converted as the participants grappled with the issue.

**Discoloration of jacket.** A final example of an activity that required the employees of Company C to create or convert knowledge is the discolored jacket and their solutions to the issue. Jamie approached Annie’s desk with a large men’s red jacket (explicit knowledge) in her hand (see Table 7). She said to Annie, “I just got this in from a client and they are complaining about the loss in warmth and the discoloration.” Jamie and Annie walked over to the worktable and placed the jacket on the table. Annie retrieved the quality sample (stored explicit knowledge) from the racks. By Annie retrieving the quality sample, she has activated the stored explicit knowledge. Jamie said,

> I need to figure out who is at fault, is the client or is it us? This large client orders these jackets for their valet personnel, so they have to match each other. Our problem is this style has been in the line for at least three years. I have no way of knowing how long it sat in the warehouse before it was shipping out.

Jamie and Annie turned the jacket (explicit knowledge) around and around in their hands as they did an external evaluation using their tacit knowledge. The discoloration was extremely noticeable when the two jackets (explicit knowledge) were compared side by side. They turned the jacket inside out and looked at the interior insulation. There was evidence of pilling (tiny balls of fiber) from abrasion in certain areas. Pilling occurs when there is a group of short or broken fibers that become entangled on the surface of a fabric (Kadolph, 2011). The pilling in this activity was a result of two fabric surfaces rubbing against each other.
Annie said, “Look, the abrasion and pilling are localized in two areas. The abrasion has caused the insulation to separate and come apart.” Annie turned the jacket right side out but left a portion of the jacket inside out, exposing the abrasion:

Jamie, look, the pockets are in the same localized area as the abrasion and pilling (tiny ball of fibers). Whoever wore the jacket, they were constantly using the pockets. The abrasion and pilling (tiny balls of fibers) is from the hands going in and out of the pockets.

Annie sniffed the jacket and asked Jamie, “Did you notice the smell?” Jamie smelled the jacket and agreed with Annie that there was definitely a distinctive odor. Annie continued, “I think I recognize the smell. It smells like, um, Oxyclean detergent. That is a really harsh detergent as I use it on my son’s soccer uniform to get the grass stains out. This could have contributed to the discoloration.”

The observations of Annie and Jamie activated the explicit knowledge of the jackets along with their own tacit knowledge. Annie and Jamie agreed the jacket’s discoloration and insulation issues were due to excess wear and tear by the customer. They were able to draw this conclusion through their inquisitive approach and use of both tacit and explicit knowledge. Jamie left to inform the customer that they would not be sending a replacement, as Company C was not a fault.

**Summary.** Each one of these activities entailed the usage of knowledge by participants. The first step in a knowledge intensive activity for the participants was to locate any and all NPD artifacts and activate their explicit knowledge. Depending on the activity, the accessed NPD artifact was in use or needed to be removed from the racks or shelves. An artifact removed from a shelf or rack represented stored explicit knowledge. For example such NPD artifacts as quality samples along with the fabric binders were stored explicit knowledge. If the knowledge was
stored it was activated into a current status the instant it was accessed by a participant. When Mary retrieved the fabric and trim books for the meeting regarding the evaluation of the oatmeal color, she was taking the stored explicit knowledge in the binders into an active state. However, the solutions for these activities were not reached merely by using explicit knowledge contained within NPD artifacts.

Tacit knowledge was activated in several activities such as Annie using the jacket neck opening as a learning moment with Mary. The tacit knowledge of how to evaluate a neck drop for Annie was activation, yet for Mary it was tacit knowledge that was created. The missing snaps presented new tacit knowledge being created for the participants as they grappled with the issue. As new knowledge was created, it also experienced conversion by the participants. The activity that best illustrated the conversion of knowledge was the discoloration of the jacket. Jamie and Annie used their skills along with the explicit knowledge within the jacket to create and convert tacit knowledge.

**Theme Three—Passive Knowledge Sharing**

In the product development process, Company C’s products advanced toward production through knowledge intensive activities such as the development of a tech flat and tech pack as mentioned in Theme Two. Within the examples of explicit and tacit knowledge, used in the activities described in Theme Two, were smaller pieces of knowledge specific to a product or an activity. These smaller pieces were the accumulation of varied information shared by the participants. Knowledge is said to be created by a flow of information which is organized by an individual. The outcome from the organization of these pieces of information was the creation and conversion of knowledge in various activities as tech packs and tech flats (see Table 5).
The use of tech packs and their associated flats illustrated the ease at which explicit knowledge was shared during product development activities. As for tacit knowledge, verbal communication was needed by the participants in order to share knowledge. Yet, during the time spent at Company C, the researcher observed that participants preferred not to communicate verbally with each other. There were a few exceptions where the participants had to communicate with each other in a face-to-face venue. One exception was in weekly meetings, where the participants shared updates on their products. Another exception was in specific activities as the discussion on a new style or solving problems with products.

When asked, the participants preferred to share their specific pieces of information through emails. Yet, Annie felt strongly that many pieces of information were still not being shared. Annie stated, “If we didn’t go out and collect it, we wouldn’t have it. We wouldn’t get it because no one’s getting up out of their chair and coming to tell us.” Yet, as far as the other participants were concerned email was the only way to share and stay informed (see Table 8). Fred, the woven production manager was of the notion that he “shared everything with everyone” even though Annie felt otherwise.
Table 8

Listing of Passive Knowledge Sharing by Participants

<table>
<thead>
<tr>
<th>Method of Passive Sharing</th>
<th>Participant</th>
<th>Shared with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emails</td>
<td>Suzie</td>
<td>All participants</td>
</tr>
<tr>
<td>Product rough tech flats</td>
<td></td>
<td>Annie and Mary</td>
</tr>
<tr>
<td>Mood boards</td>
<td></td>
<td>The VP of production</td>
</tr>
<tr>
<td>Color chips</td>
<td></td>
<td>Mary</td>
</tr>
<tr>
<td>Fabric Swatches</td>
<td></td>
<td>Annie and Mary</td>
</tr>
<tr>
<td>Fabric lab dips</td>
<td>Mary</td>
<td>Suzie</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annie</td>
</tr>
<tr>
<td>Technical packet</td>
<td>Annie</td>
<td>Mary and factories</td>
</tr>
<tr>
<td>Emails</td>
<td></td>
<td>All participants and factories</td>
</tr>
<tr>
<td>Fabric lab dips</td>
<td>Mary</td>
<td>Suzie</td>
</tr>
<tr>
<td>Technical flats</td>
<td></td>
<td>Annie</td>
</tr>
<tr>
<td>Emails</td>
<td>Fred</td>
<td>All participants and factories</td>
</tr>
<tr>
<td>Emails</td>
<td>Jamie</td>
<td>All participants and factories</td>
</tr>
<tr>
<td>Flammability and choking hazards</td>
<td></td>
<td>Company C website (public access)</td>
</tr>
<tr>
<td>Emails</td>
<td>Linda</td>
<td>Fred and Jamie</td>
</tr>
</tbody>
</table>

Knowledge sharing through emails. Here are examples of passive knowledge sharing from the various interviews with the participants.

Suzie. Suzie used both emails and various documents to share her explicit knowledge with the other participants (see Table 8). During the initial stages of developing new designs, Suzie stated, “Everything is shared through email with others. The whole team works very closely with one another. We can’t do our jobs without one another.” From the interview, Suzie mentioned not everything could be shared electronically with everyone. When she worked with Annie and Mary, explicit knowledge of developing products was shared through product sketches, mood boards, and color chips (see Table 8). A mood board is a collection of images, fabric swatches, and buttons that a designer uses for inspiration. Suzie would pin her collected images, fabric swatches, and rough tech flats to poster board. She would then share this
collected explicit knowledge with others. Suzie used the mood boards to support her tacit knowledge of the product line during presentations. When asked whom she (Suzie) shared knowledge with the most, her reply was “I work closer with Annie and Mary than the others.”

*Annie.* Annie received shared explicit knowledge from Suzie by hand in the form of product sketches, color chips, and fabric swatches (see Table 8). Annie used these various pieces of explicit knowledge as she created the tech pack for the product. For Annie, explicit knowledge was shared not only with the group but also with the factory. Her primary method of sharing explicit knowledge was through the tech pack (see Table 8). From the explicit knowledge provided in the tech pack, a factory constructed a prototype sample. These prototype samples received from the factory were their method of sharing their understanding of the explicit knowledge contained within the tech pack with Annie. Once prototype samples were received, they were stored in Annie’s workspace for further evaluation and fit.

Although the prototype samples were shipped via FedEx (Federal Express) between Annie and the factory, her method of communication was through emails with them. The usage of emails by Annie allowed for the sharing of tech packs and any additional requests for prototypes. Annie stated, “If we don't like the prototype, we get another one. I mean the amount of samples that we get amazes me.” Although Annie used email, she felt the group relied too heavily on emails. According to Annie:

> Their reliance on email was to make sure everyone knew what was happening in all areas of development. We are such a small group that we need to be able to cover for each other, if someone is on vacation or out sick. This is why I make sure to include Mary in all my emails. If I forget to include her, I will just forward her the email. They expect you to read an email that they copied you on but they’re not having a conversation with
you. The only time we’re having conversation is when we’re sitting at the table and they’re still limited. They’re still not sharing the information. They’re only sharing what they’re asked to share.

From Annie’s perspective, the lack of sharing was because “they're not very forthcoming with what they [other participants] knew. I don't know if it is because they don't know how to [share], or because they've never had to do it [share] before, or they think it's to safeguard their position and protect their job.”

Mary. Much of Mary’s knowledge (tacit and explicit) came from Annie. As the Director of Product Development, Annie felt she spent most of her day communicating with Mary, her assistant. Annie stated that “Mary will gather information, I will gather information, and we share it with each other.” Out of all the participants, it is this pairing that kept the most open line of communication for sharing. Space allocation helped with this sharing as their desks were butted against each other within an open workspace area.

Mary also received explicit knowledge from Suzie regarding color chips, fabric lab dips, and various product samples from stores (see Table 8). With the lab dips, Mary shared her results of each lab dip evaluation with Suzie, the designer. Suzie’s approval or disapproval of the color was based on her design knowledge (tacit) and the colors she envisioned within the seasonal line. Suzie also shared her preliminary product tech flats (explicit knowledge) with Mary. Mary’s ability to complete the prelim tech flats was based on her tacit and explicit knowledge of apparel products. Prelim tech flats from Suzie often required extensive additional knowledge from Mary to bring these to the standard needed for a tech flat. For those prelim tech flats to reach standard, Mary needed to add closures, pockets, and outside stitching lines. Besides adding such technical details, Mary found herself connecting and closing (computer
lines) style lines that would allow color to be added to the flat. The ability to add color to a tech flat was critical, as it would be used later in line sheets (see Table 5). Once the prelim tech flats were completed, these were shared with Annie to be used in tech packs.

At times, Mary found herself in the position of receiving various bits and pieces of information from the other participants. Mary said,

I get information both through emails a lot, but I also talk to people a lot in the group. I am somebody who has to deal with everybody and have an open conversation like every day. A lot of information kinda comes through me. I’ll get information from Jamie and then have to tell Suzie, to make sure I’m telling the factory the correct thing. I am somebody who has to deal with everybody and have an open conversation like every day. So, I prefer to have the conversation rather than receiving an email from somebody.

Fred. As the production manager for knit products, Fred stated, “I share everything related to the product through emails with the factories” (see Table 8). He mentioned, “If I gave the factories product information before the tech pack (explicit knowledge) was ready, it would just confuse the factories.” Fred also mentioned, “The more information I can get out that I think is useful for others, it is better to share with more than less.” Fred was a collector and recipient of many small but important pieces of information. It is these organized pieces of information from which Fred develops a flow of knowledge. This flow of knowledge allowed Fred to create and convert explicit knowledge as it pertained to knitting mills and knit products.

This explicit knowledge included such details as the cost of the yarn, construction cost of the knit product and delivery dates. With Fred’s product knowledge being so detailed in nature due to costing numbers (yarn and product), he preferred to share through emails with other
participants and factories. Fred’s different perspective toward how he chose to share his
knowledge contrasted with Annie’s and Mary’s opinions on shared knowledge.

Fred stated:

Oh, I share everything that I have with others, it could be in my department, or with
factories, or it could be with other people at the organization. I think that normally I’m in
a better position than the product development team [Annie and Mary] to communicate
with the factory because I understand the whole process they are in, what else they’re
doing for us. I’m the responsible person to maintain the fluid communications. Besides
all the email communications, I also think verbal communication is important.

\textit{Jamie.} Like Fred, Jamie would collect the various pieces of information that was
organized into a flow of explicit knowledge on woven products (see Table 8). The newly created
explicit knowledge contained details regarding the cost of the fabric, construction cost of the
woven product and delivery dates. Jamie shared this explicit knowledge on the woven products
with the other participants (see Table 8). She too preferred to share through emails.

Her tacit and explicit knowledge of the products extended outside of their development
and production. For example, her extended explicit knowledge dealt with laws related to the
flammability of the products and possible choking hazards (see Table 8). Flammability of a
product is determined by the rate of ignition when exposed to an open flame. Each time a fabric
is manufactured, Jamie asks for swatches from the mills. Jamie sends these fabric swatches to a
textile lab, where flammability tests are performed. The resulting flammability reports are later
shared by Jamie with the public through Company C’s website. A choking hazard was in regard
to products produced for children. In apparel products this related to such items as ribbons,
buttons and draw cords. Jamie mentioned that in the middle 90s, there were several incidents of children being choked to death by the drawstrings in hooded sweatshirts. Jamie said:

It was all reported that it was a sweatshirt, and just from the publicist article in the [Boston] Globe, I believe it was, Barry, me and Walter made the decision to, you know this is scary. This is bad for kids. We had actually removed all of drawstrings on all our warehouse product and we stopped everything from coming in.

Like Fred, Jamie was of the opinion that plenty of explicit knowledge was shared via emails with the other participants. Jamie mentioned that

The verbal communication is less than in the past because we’re all on copy (emails). We have weekly production meetings or as much as we can. We talk about all the processes of where we’re at and we have checklists of making sure that lab dips are done or sent out, or if it’s an existing fabric, everything is good. There is a lot of interaction between the tech team and the product manager.

Linda. As with the others, Linda, who is the assistant production manager, shared her explicit knowledge regarding the logistics of the products through email (see Table 8). “I deal with the quality issues from the warehouse, so I will recap my inspection notes and send them to everyone,” said Linda. Linda created new knowledge each time she performed a quality inspection on pulled products from the warehouse. The production manager of the product (Jamie or Fred) shared the explicit knowledge contained in Linda’s inspection report with the factory. When the report revealed issues that were repairable, the production managers shared them with the factory through emails.
Knowledge sharing through weekly meetings. Although emails were the first choice for sharing knowledge, casual conversations and the weekly meeting provided other opportunities. The weekly meeting allowed the group to update and share their action items. An action item is an assigned task with a specific completion date. The VP of Production directed and ran these meetings. The VP shared the latest updates regarding any product changes made to the line from her meeting with the owner and Suzie (see Table 9). As the weekly meeting progressed, members shared such status updates as the development of a new style and its color. Both of these knowledge intensive activities upon sharing created new tacit knowledge for the participants and the VP of production. When possible, the participants shared explicit knowledge such as the color chip and the corresponding fabric binder from Theme Two (see Table 5).

Another example was Fred’s sharing an email from one of his factories requesting to increase the manufacturing cost of a product. He felt the increased cost in the manufacturing of the product was acceptable even though it was higher than planned. In this example, explicit knowledge from Fred’s email was compared to the explicit knowledge of the wholesale cost of
the product. The VP told Fred, “Your manufacturing costs are too high, you need to go back to the factory and renegotiate with them.”

Jamie shared that one of her special clients had a problem accepting the wholesale cost of the product (see Table 9). A wholesale cost is the price at which a manufacturer sells finished products to retailers or clients. This wholesale cost could include the cost of raw goods (fabric), cost of findings (buttons, zippers) along with manufacturing costs (what a factory charges to complete the product). Jamie asked the VP, “Is there any possible way of reducing the wholesale cost for this special client?” Jamie continued to share with the group possible methods of reducing the wholesale cost. Jamie suggested reducing the cost by “changing the fabric used for the pocket lining to something less expensive or better yet, remove the pockets completely.” The VP commented, “Then you are creating a whole new style for one customer that will order very few units. It is just not cost effective. Tell her she can order the style as is.”

As the meeting continued, Annie shared her updates on various products by using her tacit knowledge of each product. There was one update that caught the other participants by surprise and that was the new style currently in development (see Table 9). The VP of production did not act surprised as Suzie had quickly briefed the VP on a possible new style for the seasonal line. Whereas the update activated the creation of new tacit knowledge for the participants, it confirmed existing tacit knowledge for the VP. Annie described the new style to the participants by activating her tacit and explicit knowledge on the new style. Unfortunately, Annie did not have any physical means through a previously developed tech flat or a prototype to support the creation of new tacit knowledge for the participants. She shared with the group how she used the verbal knowledge provided by Suzie before she left on vacation as her starting point. Annie said, “You just can’t tell the factory, ‘Oh, by the way, can you combine these two styles
for me?’” Annie also shared that she was in the midst of creating a tech pack for the style, but first needed to determine its appearance and fit. Annie, using her knowledge gained from the activity described in Theme Two (see Table 6), explained to the group how she blended the two tops together into one. Annie used the stored explicit knowledge in two products along with her tacit knowledge in determining the fit of the new style. The group appeared to understand the new product knowledge that Annie was sharing but that was not the case. It appeared shared tacit knowledge without supportive explicit knowledge was not effective in this instance, hence the VP’s asking for a re-explanation.

Mary was the last participant to present her product updates at the meeting and chose to continue with the new style under development (see Table 9). Her updates on the new style dealt with the fabric color as described in Theme Two (see Table 6). She shared how she found the color chip (explicit knowledge) which had been left by Suzie on her desk with very little other information. From the discovered chip and its name left on a piece of paper, Mary created new tacit and explicit knowledge regarding the new style. Mary informed the group the mill had already been notified regarding the new fabric color. She composed an informative email using her knowledge (tacit and explicit) to create new explicit knowledge for the mill. The group showed confusion on their faces when Mary shared the new color name for the fabric. The VP asked Mary to bring the fabric binder (stored explicit knowledge) and the chip (explicit knowledge) over to the table, so everyone could see how the color chip compared to the established standard. The remainder of the meeting focused on resolving the problem with the color name. Once the name had been selected and new direction given to Mary, Annie stated, “I will take the responsibility for the decision. If Suzie doesn’t like it, then that is on me. We
really need to move forward with this.” All agreed to Annie’s point and the meeting was concluded.

**Summary.** During the meeting both tacit and explicit knowledge were shared as each participant presented his or her product updates. As each update was presented, each participant created new knowledge regarding the product. For example, Mary’s update regarding the fabric color used explicit knowledge to support her tacit knowledge explanation. The use of the explicit knowledge, such as the color chips and the fabric binders, helped the group convert their tacit knowledge and helped Mary create new knowledge about the product.

**Summary**

This study has analyzed three varied sources in the findings: (a) participant interviews, (b) observations, and (c) the review of documents and product samples. From analysis of these data sources, three themes emerged in the findings with a commonality among them that ties them together. This commonality is how they related to the creation and conversion of knowledge, which is the underlining premise of the research question.

*Theme One* focused on the usage of NPD artifacts and their explicit knowledge during the product development process. Explicit knowledge was found to exist in various NPD documents and product samples specific to the fashion industry (see Table 5). In addition, explicit knowledge was created or converted when developing a tech flat or tech pack with each new or revised product. Furthermore, both types (existing and stored) of explicit knowledge were referenced and used, along with tacit knowledge held by the participants. The usage of the two knowledge (tacit and explicit) types by the participants led to the emergence of *Theme Two*—knowledge intensive activities. The development of a fit or the detailing of a tech flat was knowledge intensive because participants created, converted, and shared knowledge. In the
examples described in *Theme Two*, tacit and explicit knowledge was used in the creation and conversion of knowledge. As participants joined in knowledge intensive activities, they activated their tacit knowledge. With their tacit knowledge activated, they could create and convert knowledge as needed. From this need came the emergence of *Theme Three*—passive knowledge sharing. When asked on how knowledge was shared among each other, the preferred method was through emails. Jamie and Fred felt the emails provided everyone what they needed and it was working well. However, from Annie’s perspective the participants really did not share what they knew with each other. It was for this reason that Annie and Mary moved among the other participants sharing and asking for information that would be organized into a flow of knowledge.
Chapter 5: Conclusions and Implications

The purpose of this case study was to explore the creation and conversion of knowledge within an apparel company as they developed a product line for market. This exploration of knowledge was through the lens of knowledge creation and conversion as proposed by Nonaka’s (1994) theory. Nonaka (1994) posits that knowledge is more than just information and to view knowledge it must be placed within a context, such as a work environment. When knowledge is placed into such a context, it becomes dynamic through the interactions of individuals (Nonaka, 1994). In this study, knowledge gained context through the interactions of the participants, whether during the course of the day or in the activities surrounding the development of a product. This coupling of participants with interactions and their activities revealed how knowledge was created, converted, and shared.

Nonaka (1994) refers to creation, conversion, and the sharing of knowledge as the elements of knowledge. In this study, the elements of knowledge emerged from the findings that were collected through participant interviews and observations at Company C. In these interviews with the participants, their voices are heard as they expressed their perspective toward knowledge in the NPD artifacts and the product development process. In the findings of this study, the voices of the participants in Company C contributed to the context of knowledge as well as added depth to its descriptive characteristics. Listening to how participants viewed their knowledge was important, yet it only provided a piece of context to its usage in NPD activities and process. The other context piece came through observing participants as they applied their knowledge during NDP activities (see Table 7). An understanding of how knowledge was viewed and applied was gained through the combination of these two pieces of context.
Within this chapter are presented conclusions drawn from the analysis of the data or the findings described in Chapter 4. These conclusions are based on the framework of Nonaka’s (1994) theory of knowledge creation and conversion, as well as correlating literature on knowledge (Argote, 2005, 2010; Fiol & Lyles, 2011; Easterby-Smith & Lyles, 2011), knowledge and NPD (Hoegl & Schulze, 2005; Schulze & Hoegl, 2006) along with NPD processes (and associated activities) (Bandinelli et al., 2013; Gaskill, 1992; Goworek, 2010; Lin & Piercy, 2013; Wicket et al., 1999). This chapter is organized in the following manner: (1) conclusions, (2) implications for theory, (3) implications for practice, (4) implications for research, and (5) summary.

**Conclusions**

For this study, six participants were interviewed and observed as they completed various new product development (NPD) activities for Company C. Three conclusions were drawn from the findings: (a) product samples, technical packets and fabric swatches played a significant role in apparel NPD; (b) activities within NPD act as activators of knowledge creation and conversion and propel the product toward production, and (c) the sharing of tacit and explicit knowledge is critical to the apparel NPD process.

**Conclusion one: explicit knowledge.** Explicit knowledge contained within product samples, technical packets, and fabric swatches, played a significant role in the NPD process at Company C. Polanyi (1996) adds to the definition of knowledge with the statement that explicit knowledge cannot stand on its own. Such knowledge needs an individual to have an understanding of the corresponding tacit knowledge (Nonaka, 1994). Nonaka (1994) further explains that tacit knowledge resides within the individual and it is his/her perspective of the knowledge. It was found that these artifacts (see Table 5) were used throughout the NPD
process, and they assisted and supported the creation and conversion of tacit and explicit knowledge. This conclusion emerged from the review of information sources used by the participants and generally known as product samples and documents (e.g., tech flats, tech packets, and fabric binders; see Table 5). Within these artifacts, explicit knowledge existed in two states: current versus stored. Current explicit knowledge was found in the artifact example of tech packs, fabric binders, and product samples that were under development for the current seasonal line. Participants referenced and used these artifacts of explicit knowledge two or more times a week. For example, whether to update finished measurements or add notes on a submitted prototype sample, the new top style tech pack was referenced daily by Annie. Annie activated the explicit knowledge contained in a tech pack through her continued usage of the NPD artifact.

**Example of an apparel NPD artifact—technical packet.** A tech pack [technical packet] is an artifact document within the NPD process that contains knowledge specific to a product. The explicit knowledge contained within the tech pack is the result of the organization of various pieces of information about the product. A tech pack provides knowledge to a factory on the product’s materials and construction; it can be viewed as the NPD’s equivalent of a how-to manual. Company C’s tech packs were created from pieces of information collected by Annie and Mary. Annie proceeded to organize the collected information into product knowledge, and develop the tech pack for the style. This tech pack would undergo a continuous conversion of knowledge throughout the NPD process. The tech pack was now a NPD artifact of explicit knowledge that could be shared with Mary and the factories. The continuous spiral of knowledge occurred as revisions were made by Annie based on prototype samples and the evaluation of size set samples.
Conclusion two: knowledge activators. The activities within the NPD process are activators of the creation and conversion of knowledge and are central to propelling the product toward production. Conclusion one provided the researcher with an understanding of the role NPD artifacts played in the expression of explicit knowledge and their significance to the NPD process. However, these NPD artifacts (see Table 5) were not placed into context in terms of their usage in the development of products. For a product to progress through development, there are activities that are central in propelling the product toward production. These nuances of knowledge as it was used, created, or converted came into focus for the researcher as data was collected through the observations of NPD activities. These observed activities revealed the activation of both types of knowledge as well as progression of the product through its development.

The participants’ tacit knowledge defined the use of explicit knowledge contained within the artifacts (see Table 5). From the usage of knowledge [tacit and explicit] by the participants in the NPD process emerged Conclusion Two—the apparel NPD process contains knowledge intensive activities that act as activators. During apparel NPD activities, knowledge is created, converted, and stored or retrieved as needed (Bandinelli et al., 2013; Goffin & Koners, 2011). The problem with the neck opening on a prototype jacket sample is an example of a knowledge-intensive activity in NPD (see Table 6). Annie performed an evaluation on the factory jacket prototype sample by using the stored explicit knowledge in NPD artifacts such as the tech pack and design sample of the jacket. Annie experienced such an incident where the lack of knowledge had not been brought forward as she collected information regarding the development of the new top style (see Table 7). This NPD activity on the new top style started with Suzie and her sharing what little tacit knowledge she had developed on the new top style with Annie.
Example of knowledge intensive activities in the development of a new style. As previously mentioned, knowledge needs a starting point and for the development of the new style, it was a conversation between Suzie and Annie. Suzie had very little tacit knowledge to share with Annie because of the newness of the style. It was the common language of product development that allowed Suzie to share her tacit knowledge of the new style with Annie. Although the amount of newly-created tacit knowledge was small, it still provided Annie enough to pull two product samples of other similar styles. Annie knew the product samples on the two similar styles were not enough explicit knowledge to start the development of the new style. Annie needed additional knowledge, thus she printed out the corresponding tech packs on both styles.

A sequence of knowledge-intensive activities was started by Annie’s collection of product samples and the tech packs. Her [Annie’s] initiation of these knowledge-intensive activities led to the further development of the new style. In order to collect the information to build and organize her tacit knowledge, Annie located and pulled product samples for the other two styles to reference their stored explicit knowledge. The product samples supplied Annie with visual and tactile explicit knowledge. Yet, she also required the explicit knowledge that was documented within their tech packs. For Annie to continue in the development of the new style, she first had to convert the explicit knowledge in the NPD artifacts [product samples and tech packs] into tacit knowledge. Using her tacit knowledge of the new style design in combination with her knowledge of the other styles, Annie created new tacit knowledge concerning the look and fit of the new style. All of Annie’s activities were knowledge-intensive (see Table 7).
With the new tacit knowledge, Annie started the development of POM as she used a tape measure and the other styles. As Annie proceeded to measure the two styles and developed a set of proposed POMs for the new style, she continuously moved back and forth in her conversions of tacit and explicit knowledge. Within in this single knowledge-intensive activity, the researcher observed three out of the four conversion modes of knowledge. Annie demonstrated the usage of her knowledge of garment fit as she developed finished measurements for the new style. Annie comparing the finished measurements of the two styles achieved the development of the new finished measurements. This action utilized Annie’s own knowledge of product fit along with activating the existing product knowledge from the two styles. There were many NPD artifacts such as tech packs, prototype, and size set samples (see Table 5) along with fabric binders; tacit knowledge is needed in order to activate their explicit knowledge. Annie possessed the ability to capture and manage the new style’s knowledge, thus she displayed the corresponding tacit knowledge.

**Conclusion three: knowledge sharing.** The sharing of tacit and explicit knowledge among individuals is critical in the apparel NPD process. The researcher observed the advancement of apparel products through the developmental process by the sharing of knowledge. Each product has specific information that defines its fabric, label, and fit among other artifacts, which is contained within a tech pack along with other documents. The tech pack is the result of the collected shared knowledge from each of the participants. Those pieces of information were captured in knowledge-intensive activities and organized into a flow of knowledge by the participants, but more so by Annie. Annie had mentioned in her interview that she felt the other participants were reluctant toward knowledge sharing. This reluctance led to Annie and Mary approaching the other participants directly to ask for their piece of product
knowledge. These opposing views on how knowledge was shared along with observed NPD activities became the emerging theme three—passive knowledge sharing.

**Example of the updates on the new style at the weekly meeting.** The knowledge-intensive activities that surrounded the new style continued with updates on its progression at a weekly meeting. Both Annie and Mary had knowledge regarding the new style to share with the other participants at the meeting. Annie started off with sharing her tacit knowledge on how she developed the fit of the new style. As she shared her tacit knowledge regarding the fit and look, the participants were creating new tacit knowledge. In the meeting, it was Mary’s turn to share her tacit knowledge update on the new style. This tacit knowledge was concerning the oatmeal color chip that had been left behind by Suzie. While both the color standard and the color chip represented explicit knowledge, the two differed in its color of oatmeal. By the participants’ acknowledging the difference in the oatmeal colors, they had absorbed the explicit knowledge and created new tacit knowledge.

**Example of re-sharing the fit of the new style.** The creation and conversion of knowledge is a continual process through the various apparel NPD activities. This continual process was exemplified in the data by the event when the VP of production approached Annie after the meeting, to have her re-explain how Annie determined the fit for the new style. Annie organized the pieces of information into a flow of knowledge that she then shared with the VP of production. Annie assisted the VP of production to understand how the fit was achieved by utilizing her own knowledge in unison with the new style samples. Through Annie’s re-explanation and demonstration of the potential fit of the new style on the two styles, she clarified the process for the VP of production.
Even though Annie and the VP of production should have shared a common language, it was not enough in this circumstance. Annie possessed a higher level of competency in product design based on her past experiences than the VP of production. Thus Annie had a higher level of competency and associated knowledge of the product. When individuals do not share a common understanding of knowledge, there is a need to offer a more detailed explanation and effort to clarify the knowledge. Because the VP needed to have the fit re-explained to her, her level of competency in the area of product design is less than Annie’s.

**Summary.** For the product development department at Company C, explicit knowledge was expressed through such examples as product samples, tech flats, or tech packets. Within these various documents or product samples was either current or stored explicit knowledge. In conclusion, the explicit knowledge whether in document or product sample form was important to the NPD process in an apparel company.

The example of the new style illustrated how knowledge moved within the NPD process starting with the discussion between Suzie and Annie on the new style. Even though Annie worked alone at the early developmental phase of the new style, she still created new tacit knowledge. Annie’s high level in the competency of product design allowed her to further the development of the new style. This sharing occurred when Annie re-explained the fit development of the new style to the VP of production. The development of the new style displayed Annie’s ability to create and convert at several junctures. With knowledge being shared among the participants, it was also being converted. As the knowledge was shared and converted, it also was created as with the fit of the new style and the VP of production.

Although the participants are within the same department, their grasp of knowledge varied by their position. Because of the difference in position and experiences, how clearly
knowledge is shared can influence the development of the product. Annie’s actions demonstrated her ability to clarify how she chose to share and explain her product knowledge. Thusly, the sharing of knowledge during the apparel NPD process is a key factor toward a product’s development.

**Implications for Theory**

This segment of the section confirmed Nonaka’s (1994) views on knowledge: (a) as being more than just information, and (b) as consisting of three elements: creating, converting and sharing. Also confirmed by these findings are Nonaka’s (1994) three assumptions of knowledge which are: (a) tacit knowledge resides within an individual explicit (b) knowledge exists in such formats as manuals and documents, and (c) knowledge is created and converted.

Although information is a basis for knowledge, that information needs to be collected and organized by an individual. The collection of information, when organized, creates a flow of knowledge. The perception of knowledge held by the participants was from the perspective of information. The participants referred to their knowledge as information during the interviews. From this point of view, they knew pieces of information regarding the products. It was those pieces that Annie and Mary needed to collect and organize into product knowledge. Once the information was collected, Annie and Mary organized it into a flow of knowledge on each product. This product knowledge resulted in the conversion of tacit to explicit knowledge as Mary and Annie developed tech packs (technical packets) and tech flats (technical flats).

Nonaka (1994) mentions that the action of sharing knowledge is a continual dialogue that is time consuming. Both Annie and Mary mentioned that if they did not go and collect the information, they would not have it for the products. They also felt at times that it consumed their daily activities as they tracked the information down so it could be organized into product tech packs.
Nonaka (1994) states explicit knowledge can be found in such formats as manuals, presentations, and documents. Whether from a tech pack or a product sample, explicit knowledge was used throughout the knowledge-intensive activities in the development of a product. The development and completion of these products is an overall goal of the department and its company. The observations of the participants in Company C’s NPD process not only brought context to knowledge but also brought it to life. The observations surrounding the new style provided context to the knowledge that was being shared among the participants. The color chip issue at the meeting regarding what is or is not an oatmeal color activated the tacit knowledge in Jamie. Jamie remembered there was already an existing oatmeal color and that adding another would merely confuse the retail consumer. It appeared that the other participants did not hold the same reference point of color knowledge, which hindered the creation and sharing of knowledge without further effort from Mary. In an effort to clarify for the group, the VP of production had Mary bring the fabric binder over to the table, so all could see the color difference. With the color chip and the established color standard sitting side-by-side, the group’s knowledge on the color was placed into context by the comparison.

Nonaka (1994) argues that knowledge is created through a continuous dialogue of tacit and explicit knowledge. This continuous dialogue between the two types of knowledge was exhibited during the development of the new style (Nonaka, 1994). Suzie’s and Annie’s conversation started the continuous dialogue for Company C’s NPD on the new style. In this conversation Suzie shared her tacit knowledge of the new style with Annie, thus new knowledge was created. From this newly-created tacit knowledge, Annie utilized the stored explicit knowledge from two similar style tops as she developed the look and fit of the new style. As Annie activated the stored explicit knowledge of the two tops, she converted the knowledge into
tacit knowledge. Nonaka (1994) illustrates his continuous dialogue of knowledge through the four knowledge conversion modes of SECI (socialization, externalization, combination and internalization). Within these modes is where both tacit and explicit knowledge experience conversion and creation through the sharing of knowledge. Socialization is the mode that illustrates the sharing of tacit knowledge and its conversion to tacit knowledge (Nonaka, 1994). The conversation between Suzie and Annie regarding the new style exhibited the socialization of the knowledge for the new style. This mode also reflects Nonaka’s (1994) belief that knowledge resides within the individual. The second mode in the SECI processes is that of externalization (Nonaka, 1994). Within this mode knowledge experiences conversion again as it goes from tacit to explicit. For the new style to advance, Annie converted the tacit knowledge created from the two tops into explicit knowledge as she generated a tech flat for the new style. The generated tech flat of the new style was placed by Annie into its corresponding tech pack and is shared with the factory.

The knowledge contained within the new style tech pack was developed by Annie’s actions of generating tech flats and finished measurements. The development of a tech pack is the conversion of explicit to explicit knowledge and illustrates the mode of combination (Nonaka, 1994). The last mode in the knowledge conversion process is that of internalization, as explicit converts to tacit (Nonaka, 1994). In the development of the new style, Annie internalized the stored explicit knowledge on the fit of the two tops. With the explicit knowledge now converted to tacit, Annie was able to share how she achieved the fit of the new style at the weekly meeting with the other participants.

Sharing is an element of knowledge and is key in the knowledge conversion mode of socialization (Nonaka, 1994). Participants of the study shared their product updates with each
other at the weekly meeting. During this meeting both Annie and Mary shared their product knowledge regarding the development of the new style. Annie shared how she determined the fit for the style, while Mary mentioned the color name. The sharing of knowledge requires a level of flexibility when applied in a problem-solving action as demonstrated by the participants during the color name incident.

When knowledge is shared within a self-organizing team such as the product development department it takes on a level of flexibility (Nonaka, 1994). This flexibility in sharing arises during problem-solving actions such as the color name for the new style. All participants shared their knowledge on the oatmeal color from their perspective. Jamie referred back to products already in existence with the oatmeal offering, while Mary referred back to her note from Suzie and a fabric swatch book. From this shared knowledge, the participants were able to discuss and resolve the color name issue.

The sharing of tacit knowledge is essential to the socialization mode in Nonaka’s knowledge conversion processes of SECI. Annie’s tacit knowledge was central in the development of the new style. She activated it during the conversation with Suzie and as she developed the fit and tech pack. Annie’s actions during the corresponding knowledge intensive activities combined with her tacit knowledge advanced the new style toward proto sampling. She also shared her tacit knowledge regarding the evaluation of a neck drop with Mary, thus creating a learning moment and opportunity for Mary to create new tacit knowledge. Nonaka’s assumption that knowledge resides within an individual is confirmed by the Annie’s usage and sharing of her tacit knowledge.

Nonaka (1994) states that explicit knowledge is capable of standing by itself, as it is self-contained within the document, or manual. The findings did confirm that NPD artifacts are
examples of explicit knowledge in product development. Yet it does not confirm the ability of explicit knowledge to stand by itself in apparel product development. NPD artifacts differ for apparel product development in that the stored knowledge needs to be activated by a participant (Polanyi, 1996). The participant must possess the corresponding tacit knowledge for that particular NPD artifact; otherwise the potential for the usage of the knowledge is not reached. Annie demonstrated how the stored explicit knowledge of two top styles reached its full potential as she utilized it in determining the fit of the new style. These two NPD artifacts and their stored explicit knowledge were activated by Annie’s tacit knowledge of product design. Another example is the re-explanation conversation on how the fit was achieved between the VP of production and Annie. The sample NPD artifacts were used and activated by Annie as she re-explained to the VP of production how the fit was achieved. Both of these examples confirm that apparel NPD artifacts and their explicit knowledge, whether stored or current, need to be activated by a corresponding tacit knowledge.

There are examples within the findings that extend Nonaka’s (1994) premise on sharing as it pertains to the quality of the knowledge shared and its timing. Such influences on knowledge were not addressed within the theory. An example of the quality of knowledge shared was demonstrated in the conversation between Suzie and Annie. Suzie provided such small pieces of knowledge that Annie needed to determine certain product features by using her tacit knowledge of product design. Annie brought this up at the weekly meeting and would “take the hit” when Suzie returned from vacation, if the product did not meet her expectations. The end result of Annie’s actions had two possible outcomes: (a) Annie spends two weeks developing a style and it meets Suzie’s expectations or (b) Suzie does not approve and Annie starts over again developing the style.
An example of knowledge sharing influenced by timing is the incident of color name (see Table 8). During the weekly meeting, Mary updated the group on the newly requested oatmeal color swatch from the mill. She informed the group that Suzie had left a color chip attached to a piece of paper on her desk. Mary informed the group that the oatmeal color chip had been forwarded to the mill. Upon Mary’s mentioning the color name, Jamie stated oatmeal existed and that having two different colors would confuse sales. A discussion followed regarding the color swatch that resulted in a new name. Mary needed to inform the mill as quickly as possible, so they did not knit up the other oatmeal. The concern at this point for the VP of production was stopping the mill from knitting the wrong color.

**Implications for Practice**

The attention to detail is never more critical than during the development of an apparel product. Such a small thing as a color chip holds valuable explicit knowledge for Suzie, when planning a new style top. This same color chip is what Mary shared with knitting mill, so they could start dyeing yarn for production. The explicit knowledge in the color chip did not change; the difference between the two examples is in how Mary and Suzie used the chip’s knowledge. Stored explicit knowledge is found to exist in other NPD artifacts such as a technical packet or a product sample (see Table 5). Yet, to activate this knowledge an individual needs to possess an understanding of how to use that knowledge. For example, a product sample for Suzie provided her with inspiration and tacit knowledge that was used to design a new style, while this same product sample provided Annie a source of visually explicit knowledge that was utilized in determining a fit for the new style. Because of the product details captured by explicit knowledge artifacts, their importance to the NPD process cannot be stressed enough. It is up to
each apparel company to ensure that product development departments are properly recorded and stored, so these NPD artifacts can be referenced at a later date.

The examples mentioned above reflect the difference in the usage of stored explicit knowledge in a NPD artifact. What the examples did not reflect is the possibility of an NPD activity (see Table 8) activating the stored knowledge. The discoloration of the jacket is an example of a NPD activity that required the activation of stored explicit knowledge. With the jackets side-by-side, Jamie and Annie discussed the possible causes for a jacket to lose its color. This discussion led to Jamie and Annie activating the tacit knowledge that is within each of them. By talking out the possible causes of discoloration, Jamie and Annie shared their tacit knowledge, as they perceived the visual explicit knowledge from the jackets. The discussion between Jamie and Annie demonstrates the importance that tacit knowledge has in the NPD process. Tacit knowledge is what an individual knows and has gained through personal experience and education. When individuals share common experiences and education it assists in the communication and the sharing of product knowledge. For instance, Suzie mentioned there were times while designing when she would consult with Annie regarding the design. Suzie felt comfortable with Annie’s knowledge of product design due to her years of experience. These two individuals shared a common tacit knowledge of product design, yet Annie’s level of competency in product design was greater than Suzie’s due to her years of experience. Apparel companies must understand the value that both types of knowledge contribute to the NPD process. For without the activation and usage of knowledge, the products would not move forward to production.

There must be an understanding by apparel companies that as a product moves in development, so does its corresponding knowledge. The sharing of knowledge is a critical
element to the NPD process, as it directly affects the development and success of a product. Whether the choice is sharing product knowledge through an email or a conversation, it is important in the NPD process. Although individuals may share a common experience such as working within the apparel industry, it does not ensure they share a common tacit knowledge. This mismatch of tacit knowledge was prevalent in the re-explanation of the new style fit conversation between Annie and the VP of production. Both of these individuals have worked in the apparel industry, but for different lengths of time and in different sectors of product development. Supervisors should be aware of the variations in tacit knowledge among their employees. The length of employment time may be one key to the amount of knowledge held by one person, but experience and other skills may also affect a person’s tacit knowledge.

As was seen with the conversation between Annie and the VP, clarity in the sharing of knowledge in NPD is extremely important. A misconstrued or ill-explained detail can lead to problems further on in the development of the product. An example of such a problem was discovered during Mary’s update presentation at the weekly meeting. Suzie had left little instruction for Mary regarding the color development for the new style. When trying to share knowledge a variety of sources or artifacts may be needed to help clarify the knowledge and to ensure that all involved are clear about the knowledge. When knowledge is incomplete within an artifact or when knowledge is not adequately shared the outcomes in the NPD process may not be correct.

**Implications for Research**

This study provides a foundation for further research and an establishment of a connection between the apparel NPD and knowledge. Whether it is the automotive (Schulze & Hoegl, 2006) or apparel industries (Gaskill, 1992), the NPD process is composed of various
stages. At the time that the observations were conducted, the products were in the development stage. This stage at Company C consisted of developing a new style, evaluation of prototype samples, and fabric color approvals. According to NPD models developed by Gaskill (1992), Glock and Kunz (1993), and Goworek (2010), the titles given to the stages vary among researchers. What are common among these models are their descriptions of the activities that occur in each stage. In pursuing the connection between apparel NPD and knowledge, it would be best to develop a more compact model of the stages using Goworek’s (2010) as a starting point.

Such a model would offer a correlation to Schulze and Hoegl’s (2006) research of the knowledge creation modes (SECI) and their occurrence within the NPD process in non-apparel industries. Schulze and Hoegl’s (2006) model only reflects two stages of NPD, concept, and development. While these same stages exist in Goworek (2010), the Schulze and Hoegl’s (2006) model is limited in its application to the NPD process in apparel. Although Schulze and Hoegl’s (2006) stages are not similar to apparel NPD, by using the newly-developed model a stronger correlation could be drawn between the two research areas. For example, the conversation of the new style between Suzie and Annie would appear in the concept stage in Schulze and Hoegl’s (2006), while appearing in Goworek’s (2010) design and development stage. Since the socialization and externalization modes occur in the concept stage (Schulze & Hoegl, 2006), it would follow that they occur in the design and development stage (Goworek, 2010). The initial correlation between apparel NPD and knowledge creation modes needs to be explored more deeply through a newly development model.

With knowledge being established as being present within the apparel NPD process, it will now be necessary to draw a correlation to the NPD activities. The established correlation
between the knowledge creation modes and the apparel NPD process needs to occur with the activities in that process. D’Avolio et al. (2015) view the NPD process as being composed of knowledge-intensive activities. Bandinelli et al. (2015) view the NPD process as a series of activities that entails the creating, sharing, and retrieving of knowledge. On the other hand, d’Avolio et al. (2010) primarily views the process as being composed of knowledge-intensive activities focused on a product. Annie’s activities (see Table 8) in the development of the fit for the new style illustrate the viewpoint of d’Avolio et al. (2010). The findings of this study illustrate the viewpoint of Goffin et al. (2010), which is that NPD is a combination of problem-solving processes residing in a complex system. Adding to the complexity of the NPD are its knowledge intensive activities (Goffin & Koners, 2011) that are used to move a product through development.

**Suggestions Future Research**

To illuminate further the connections between knowledge and the NPD process in the apparel industry, future research studies could be performed to develop a more comprehensive model of the NPD process and the knowledge creation, conversion, and sharing that occurs throughout the process. Because this research represents one case study with a single product, future studies could include the addition of multiple products occurring over multiple selling seasons. With future research considering how multiple products and seasons would influence knowledge creation and conversion; such data would help evaluate the validity of the model based on the exploratory research about Company C with the NPD and knowledge.

This additional research and its expansion across companies and products could also be combined with more research connecting the knowledge in the NPD process with the other segments of the industry. A model reflecting a more comprehensive or higher level of NPD
process could be the outcome of future studies. This potential outcome of future research (e.g., a model at a higher level than one case study) may provide future researchers and practitioners with critical information about the creation and conversion of knowledge and in relation to the NPD processes used in the apparel industry.

Summary

This case study explored knowledge creation and conversion at a small apparel manufacturer as they engaged in the development of products for market. This case study’s findings provided a unique insight into product development through the lens of knowledge creation and conversion. The insights gained from the analysis of the findings lead to the following three conclusions: (1) product samples, technical packets and fabric swatches play a significant role in the apparel NPD; (2) activities within NPD act as activators of knowledge creation and conversion and are central to the progression of the product, and (3) the sharing of knowledge is critical in the apparel NPD process. From these three conclusions, the researcher makes the following suggestions:

(1) The various reference apparel NPD artifacts (see Table 5) need to be acknowledged for their value that they add to the apparel NPD activities. Acknowledging the importance of knowledge contained within those apparel NPD artifacts will increase the activation of stored explicit knowledge. This increased activation would lead to an increase of the explicit knowledge supplementing an individual’s tacit knowledge of the apparel NPD artifact.

(2) Those individuals involved in the apparel NPD process possess a knowledge that allows them to activate the knowledge in the apparel NPD reference artifacts. As
with the apparel NPD artifacts, the knowledge of the individuals has value that contributes to the overall success of a product.

(3) Each activity in the apparel NPD process requires the activation and usage of knowledge.

(4) The sharing of knowledge affects to varying degrees the quantity of knowledge an individual chooses to share as well as its quality.
References


doi: 10.1016/j.knosys.2011.02.003


doi: 0.5772/56856


http://dx.doi.org/10.1080/17543266.2015.1005697


*Journal of Knowledge Management, 9*(2), 91-102. doi:10.1108/13673270510590245


doi: 10.1108/09556220610637512


doi:10.1093/icc/dth058


### Appendix A – Side by Side Listing of NPD Stages

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Trend analysis</td>
<td>Inspirational search for trends</td>
<td>Research</td>
</tr>
<tr>
<td>Concept evolvement</td>
<td>Trends analysis</td>
<td>Directional shopping &amp; comparative shopping</td>
</tr>
<tr>
<td>Palette selection</td>
<td>Theme development</td>
<td>Fabric source &amp; fabric development</td>
</tr>
<tr>
<td>Fabric selection</td>
<td>Palette development</td>
<td>Garment design development</td>
</tr>
<tr>
<td>Fabric design</td>
<td>Structural fabric decision</td>
<td>Garment design presentation</td>
</tr>
<tr>
<td>Silhouette generation</td>
<td>Fabric surface design directions</td>
<td>Range planning &amp; selection</td>
</tr>
<tr>
<td>Prototype construction &amp; analysis</td>
<td>Silhouette generation</td>
<td>Range development &amp; finalization</td>
</tr>
<tr>
<td>Line presentation</td>
<td>Prototype construction &amp; analysis</td>
<td></td>
</tr>
<tr>
<td>Subsequent activities</td>
<td>Line presentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fit &amp; style perfecting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production pattern making</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Materials / garment specification writing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production sourcing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final cost estimation &amp; specification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>determination</td>
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</tbody>
</table>
Appendix B: NIH Human Subject Training

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that Kathleen Evans successfully completed the NIH Web-based training course “Protecting Human Research Participants”.

Date of completion: 12/31/2011

Certification Number: 810310
Appendix C: Northeastern University IRB Approval

NOTIFICATION OF IRB ACTION

Date: August 1, 2016  IRB #: CPS16-06-09
Principal Investigator(s): Tova Sanders
                        Kathleen J. Evans
Department: Doctor of Education Program
           College of Professional Studies
Address: 20 Belvidere
        Northeastern University
Title of Project: An Exploratory Case Study: Knowledge Creation and Conversion within a Small Apparel Wholesaler
Participating Sites: Charles River Permission in file
DHHS Review Category: Expedited #6, #7
Informed Consents: One (1) signed consent form
Monitoring Interval: 12 months

APPROVAL EXPIRATION DATE: JULY 31, 2017

Investigator's Responsibilities:
1. The informed consent form bearing the IRB approval stamp must be used when recruiting participants into the study.
2. The investigator must notify IRB immediately of unexpected adverse reactions, or new information that may alter our perception of the benefit-risk ratio.
3. Study procedures and files are subject to audit any time.
4. Any modifications of the protocol or the informed consent as the study progresses must be reviewed and approved by this committee prior to being instituted.
5. Continuing Review Approval for the proposal should be requested at least one month prior to the expiration date above.
6. This approval applies to the protection of human subjects only. It does not apply to any other university approvals that may be necessary.

C. Randall Colvin, Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina, Director
Human Subject Research Protection

Northeastern University FWA #4630
Appendix D: Gatekeeper and Site Access Request

Dear Anne Greensprings,

Hi, my name is Kathleen Evans, a graduate student at Northeastern University. I am seeking your assistance to be the main contact individual during the research study at Charles River Apparel Company. As the main contact individual, you will act as gatekeeper between your company and myself.

Before proceeding, I will assure you that this would not increase your daily workload. As the gatekeeper, I will reach out to you seeking permission to visit your facility. There will be other requests as the study progresses such as attending departmental meetings or sales meetings. I will also request permission to review documents that are in used during the development of a product line. The study also includes as series of interviews, so I will be asking you in the future for names and contact information of potential participants. I am also seeking permission to recruit employees for interviews and to have access to observing them at work.

The study that you will be participating in deals with the occurrence of knowledge during the development of products for market. The study is titled, “An Exploratory Case Study: Knowledge Creation and Conversion within a Small Apparel Wholesaler”. I will be happy to discuss with you in detail any aspects of the study.

Your participation as the gatekeeper for this study will be strictly voluntary. You also have the ability to withdraw from the study at anytime. If you are agreeable to serving as gatekeeper for the study, please acknowledge and sign below. Right now, all your permission will do is allow me to recruit participants. I am not asking for you to participate at this time.

Your participation is voluntary. If you do not contact me regarding this research, I will not contact you again.

If you are interested in volunteering to be the gatekeeper and wish for additional information concerning the study or have any questions about the study, please e-mail Kathleen Evans at evans.ka@husky.neu.edu or call at (617) 332 – 5158.

Thank you for your consideration.

Best,
Kathleen Evans
Appendix E: Participant Recruitment Letter

Dear (Name of Participant):

My name is Kathleen Evans and I am a doctoral candidate at Northeastern University in Boston, MA. I have worked as a fashion college instructor and department chair for over 12 years and have 10 years of apparel industry experience. As you know, I am conducting a research study as part of the requirements of my doctoral degree in Organizational Leadership. You are receiving this email as you so graciously agreed to become a participant of the study.

I am asking you to volunteer to participate in my study. You will be asked to participate in an interview that will last between 45 to 60 minutes. We will work on scheduling a day and time for the interview that will work around with your daily hours at Charles River Apparel. This interview will consist of a series of open-ended questions regarding your knowledge of the apparel industry. There will be other questions regarding your job descriptions and tasks within the company. This will take place in any location you choose.

I am also asking to observe you at work. I would like access to documents such as product technical specification packets, company catalogue, seasonal line sheets, and fabric approval logs.

Again, your participation in this study is voluntary and you do not have to be part of this study, if you do not wish. If you are interested in volunteering to participate or have any questions about the study, please e-mail me at evans.ka@husky.neu.edu or call at (617) 332–5158. You will not be contacted again regarding this research.

Thank you for your consideration.

Sincerely,

Kathleen Evans
Appendix F: Participant Consent Letter

Northeastern University, Doctor of Education
Name of Investigator(s): Dr. Tova Sanders - Principal Investigator; Kathleen Evans – Graduate Student Researcher
Title of Project: An Exploratory Case Study: Knowledge Creation and Conversion within a Small Apparel Manufacturer

Informed Consent to Participant in a Research Study – Charles River Apparel Company employee.

We are inviting you to take part in a research study. This form will tell you about the study, but the investigator will explain it to you first. You may ask this person any questions that you have. When you are ready to make a decision, you may tell the investigator if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the investigator will ask you to sign this statement and will give you a copy to keep.

Why is this research study being done?

The purpose of this case study is to explore the process of knowledge creation and knowledge sharing within a small apparel company as it develops a product line for market.

What will I be asked to do?

You will be asked to participate in interviews and observed during your interactions with Charles River Apparel Company employees. This single case study focuses on Charles River Apparel Company and the knowledge that is created and shared during the development of a product line. It is to explore how you gain and share knowledge through these interactions from researching the style and color trends to working on product line sheets and the sharing of that knowledge at meetings.

Where will this take place and how much of my time will it take?

Your interview should last approximately 45 to 60 minutes. The interview session will be audio taped, so that I can accurately reflect on what is discussed. The tapes will be reviewed by a secured web-based transcription service that will transcribe the information. After they have been transcribed, I will analyze them for common themes on how you gained your knowledge. At this time, I do not foresee additional interviews. If another interview is necessary, again you may choose not to participate.

Along with the interview participation, there will be occurrences where you will be observed during meetings with other Charles River Apparel Company employees. I will be taking notes of these interactions and as well as looking at various product lines paper and computer work that
you have been assigned. Some of the questions in the interview will be based off your job responsibilities at Charles River Apparel Company.

**Will there be any risk or discomfort to me?**

The foreseeable risks may be you feeling that it is taking away from your business and productivity. You can be ensured that we understand the importance of your business and how critical deadlines are in the apparel industry. Every effort will be made during the course of the study not to infringe on the operations of your daily business. To minimize any risks of interruptions, the student investigator will always ask you if it is an appropriate time to talk to you about your business. The student investigator will always seek permission prior to discussion, attending meeting and looking at business records and products. Again, you as a participant may withdraw or decline answering questions or access to business information at anytime.

The student investigator does not foresee any additional risks or discomforts occurring, then previously stated above.

**Will I benefit by being in this research?**

You will not receive any direct benefit from this study. It is the hope of the student investigator that the apparel industry and fashion education will gain benefits and insights on how knowledge is created and shared during the product development cycle.

**Who will see the information about me?**

Your part in this study as well as other participants will be kept strictly confidential. The student investigator has safeguards in place to protect your privacy, confidentiality, and anonymity during the course of the research. As the collected information will be proprietary in nature, methods are in place to keep the information secured during the course of the study. At the end of the study, all information will be properly destroyed. The company name and the name of the participants will remain fictitious during the course of the study and will appear in the same manner in any presentation or written reports.

Your information will be protect and secured in lone location, the student investigator’s home office. Fictitious names will be assigned to each participant to ensure their anonymity. The collected information will be stored in electronic format on an external drive and the main computer drive of the student investigator. All the information will be properly destroyed through the student investigator’s personal shredder. Interviews will be taped and transcribed by a secure service. The service, the principal investigator, and the student investigator will be the
only ones that will see the completed files. A copy of the transcription will be give to you as soon as the student investigator has received it from the service.

All the information that will be collected during the study will appear in a written doctorate thesis. Again, all the names of the participants and the company will be fictitious to protect the privacy and confidentiality. The information and data may appear in presentations or in professional journals, however the names and the company will remain fictitious.

There may be at some point during the study that authorized individuals may request to review the research material. This review is to ensure that the research is being conducted properly. The Northeastern University Institutional Review Board will authorize those individuals.

**What will happen if I suffer any harm from this research?**

No special arrangement will be made for compensation or for payment for treatment solely because of my participation in this research.

**Can I stop my participation in this study?**

Your participation in this research is strictly voluntary. If at anytime you change your mind and no longer wish to participate, just inform the student investigator. You may withdraw your consent to participate without any fear of reprisal or penalty.

**Whom can I contact if I have questions or problems?**

If you have any questions about this study, please feel free to contact the Principal Investigator, Dr. Tova Sanders at T.Sanders@neu.edu or call her at (202) 549-324. You may also contact the student investigator, Kathleen Evans at kjstitches@gmail.com or call her cell at (408) 624-7806.

**Whom can I contact about my right as a participant?**

If you have any questions about your right in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, 490 Renaissance Park, Northeastern University, Boston, MA 02115. You may also call her at (617) 373-4588 or email her at n.regina@neu.edu. You may call anonymously, if you wish.

**Will I be paid for my participation?**

Participants of this study will not receive any type of payment.

**Is there anything else I need to know?**

- You must be at least 18 year old to participate in the research study.
- You must be an employee of Charles River Apparel Company
I agree to take part in this research.

__________________________  ______________________
Signature of person agreeing to take part                        Date

__________________________
Printed name of person above

__________________________  ______________________
Signature of person who explained the study to the participant above and obtained consent                        Date

__________________________
Printed name of person above
Appendix G: Interview Script

Interviewee Name ___________________________                         Date _________________
Title ___________________________________
Student investigator _________________________________

Hi, my name is Kathleen Evans but please call me, Kathy. I am graduate study at Northeastern University currently conducting a research study on how knowledge is created and used within the apparel industry. This research study is a requirement of all doctorate students. I would like to thank you and say I truly appreciate you taking the time out of your day to participate in this interview. It should not take anymore than 45 to 60 minutes of your time. If you wish to stop at anytime due to urgent business matters, we can reschedule and finish our interview at a more convenient time.

I would like to ask your permission to audiotape the interview, strictly for research purposes and capture accurately the information that you are sharing. What will happen to your audiotape is it will be sent to an electronic transcription service, which turns it into a word document. Once I receive the document back from the services, it will be shared with you. You will be able to review your comments. I would like to remind you that all your comments would be kept confidential through the whole process.

As I mentioned earlier, this interview will be exploring how knowledge is created and used within apparel industry. So, the questions that I will ask you will deal with your perceptive on how you, yourself use existing knowledge, along with creating and sharing knowledge. What I mean by existing knowledge could pertain to specifics on a product line for a client, the demographics of your client or your knowledge of the industry as a whole. As for new knowledge that could be the preparations toward the development of a new product line, the research of colors, styles and fabrication to the sourcing for production.

The questions that you will be asked are in four areas of interests that will contribute to the overall results of the study. These areas are: personal knowledge, existing knowledge, new knowledge, and sharing knowledge.

1. Who do you receive information from?
2. Who do you share information with?
3. How is information shared with you?
4. How do you share information with others?
5. When is information shared with you?
6. When do you share information with others?
7. What information is shared with you?
8. What information do you share with others?

I would like to thank you for your time today and ask you, is there anything you wish to add?
Appendix H: Observation Protocol

Participant Name(s) ___________________________                      Date _________________

Activity___________________________________

Student investigator _________________________________

Hi, my name is Kathleen Evans but please call me, Kathy. I am graduate study at Northeastern University currently conducting a research study on how knowledge is created and used within the apparel industry. This research study is a requirement of all doctorate students. I would like to thank you and say I truly appreciate you taking part in this research study. The observations for this research do not require any additional time on your part, as they will be conducted during the course of meetings, presentations, and other work activities. All observations are strictly for research purposes, as it will capture the how knowledge is being created and shared during such interactions.

I would like to ask your permission to observe your interactions with Charles River Apparel employees. You are not being singled out in these observations, as I will be observing all of those individuals involved. I will be capturing these activities in what is called field notes. Field notes are a tool researchers use to jot down notes of observed activities, much like when you would take notes of a class lecture. These field notes are reviewed and summarized at the end of each day.
Appendix I: Observation Field Notes Template

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
<th>Location:</th>
</tr>
</thead>
</table>

Participants:

Length of observation:

Activity:

Perceptions:
Appendix J: Proprietary Protocol

1. On site
   
a. Seek permission.
      
i. Prior to handling of any type of document, a request or a discussion will occur between the gatekeeper and the student investigator.
      
ii. At the same time, permission will be gained in regarding photocopying of material or photography of samples.

b. Review of documents
   
i. Reviewing of documents will occur where the document is stored.
   
ii. Notations will occur on the proper developed appendix

2. Home office
   
a. Daily notes
      
i. Copies of the daily notes will be transferred to the main computer.
         
1. One copy will reside on the external hard drive
         
2. One copy will reside on the main computer
      
ii. Hard copies of daily notes will be filed
         
1. Filing system will consist of ring binders properly divided by date.
         
2. Binders will be store in locked file cabinet.

b. Interviews
   
i. Recordings will be sent out for transcripts the day of the interview
   
ii. Transcribed copies will be stored in a locked file cabinet.
Appendix K: Data Collection Protocols

Interviews

- Script (Appendix G) will be read at each interview.
- A quiet and private location will be secured at the research site, so to ensure the participant’s confidentiality.
- Questions will be open ended.
- Interviews will be recorded, and then sent to a transcription company. Upon the return of the transcribed copy, it will be given to each participant for his or her review.

Observations

- Script (Appendix H) will be read prior to the observation starting.
- Researcher will not partake in meetings; they will sit to the side quietly recording in field notes.
- If allowed, the meeting will be recorded and later transcribed.

Document Review

- Permission will be gained each time documents are reviewed.
- Documents will include technical packets, style and line sheets, trends and forecasting reports and time action calendars.
- Documents will also include physical artifacts such as prototypes and sales samples.
Appendix L: Documentation Review Notes Template

Documentation Review

Documentation Title: 
Document Type: Specification Packet & Catalogue 
Date: 
Time: 
Location: 

Additional reference: Catalogue page: 

Purpose: 
• Number 
• Specific for vender – 

Notes: 
• Appears that style was intro in 
• Changes 

Additional info from 2016 catalogue: 

Questions: 
• When was the style introduced? 
• When did the style go into production 
• Who was here for the sample run changes
Appendix M: Artifact Review Field Notes Template

Record #

Documentation Title:
Document Type:
Date:
Time:
Location:

Purpose:

Notes:
Appendix N: Storage Protocols

• All collected documents will be treated as proprietary, thus stored in secure manner.
• Physical documents will be placed in a locked file cabinet at the student researcher’s home office.
• Electronic files will be stored on three different devices as to protect the files from corruption. Each device will be password protected.
  o Computer – two computers will be used during the length of the study. The main computer will reside in the office of the student researcher’s home. The second computer will be a laptop that the student researcher will use at the research site.
  o External hard drive – an external hard drive will be used as a backup for all the data and the research files during the course of the study.
• Upon completion of the study, the files will be stored in locked and password protected environment as the student researcher’s home office.
• After three years, the files will be destroyed in the following manner:
  o Paper documents will be shredded using the student researcher’s personal shredding machine.
  o Electronic files will be wiped from all computers and the external hard drive.