



## CONSUMER PURCHASE DATA AS A STRATEGIC PRODUCT DEVELOPMENT TOOL

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### ABSTRACT

*As the apparel market becomes progressively more competitive and market driven, manufacturing firms must cultivate the ability to design and develop products responsive to the changing wants and needs of their customers. Product attribute analysis of consumer purchases provides insight into product preferences and changing preferences over time. This study examined the attributes of intimate apparel purchased in a department store. Patterns of consumer's preferences were found in the attributes of products purchased when analyzed both overall and individually by manufacturer. In addition, this research examined use of attributes to forecast purchase behavior and to identify features important for product development. Results of the study have implications for the use of point of sale (POS) data by manufacturers of apparel products.*

**KEYWORDS:** Product development strategy, Evaluative criteria, Consumer purchase, Product attributes, Attribute forecasting

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### Introduction

To remain competitive and profitable, the apparel industry must continue to improve its ability to respond to the wants and needs of consumers. The last decade witnessed the gradual evolution of the industry from a traditional "push mode" of producing and then selling product to a "pull mode" of anticipating consumer demand and delivering appropriate product. This evolution to a more market responsive industry has driven change in many aspects of the business environment including product design and development. Consistent with this trend, increased emphasis on improving the apparel product development

process can be noted in the industry trade literature in recent years. New product development is viewed as the next critical focus for companies who have improved their supply chain performance (Conrad, 1999). Continued globalization of the industry and ever expanding efforts to market products internationally increase the need for detailed understanding of the increasingly critical role of the consumer in the product design and development process.

One strategy employed in efforts to make products more consumer responsive is use of methods such as data mining to reveal information contained in large stores of detailed data. Data mining is undertaken on the premise that useful insights into behavior

can be obtained via analysis of historical data (Mason, 1995). The strategy is exemplified by use of point-of-sale (POS) data, an electronic record of consumer purchases, for identification of trends and early identification of purchase patterns (Bonner, 1996). Use of POS purchase records provides easy access to data regarding consumer behavior and provides a much larger sample of target consumers than many other market research strategies. Manufacturers may use purchase data to forecast trends in color and style, and to predict the sales potential of new products. POS purchase data may even be used to drive “attribute replenishment”, or model stock substitution, programs that replenish products with similar attributes when an ordered product is unavailable (Irastorza & Way, 1996).

### **Purpose of Study**

The purpose of this research was to determine if an attribute level analysis of product purchases would reveal patterns in the aesthetic and technical design attributes of the products purchased.

### **Conceptual Framework**

In a competitive marketplace, a firm’s objective is to provide consumers with a product that will be chosen for purchase from among the many alternatives available. Consumer decision process theory provides a framework for understanding how consumers select from among alternatives. In particular, the Engel, Blackwell and Miniard (1995) model of the consumer decision process clarifies that consumers choose from among alternative products on the basis of evaluative criteria, or particular product dimensions or attributes. Examples of such criteria include design, color, price and brand name. Evaluative criteria used by consumers in making a purchase vary in quantity and

salience, and those used in any single purchase decision may differ from those used in another purchase decision. A company can develop products that will be chosen from among competing products by understanding the optimal set of evaluative criteria used by the consumer in making a purchase decision.

Most products, even complex ones, are evaluated primarily on the basis of five to seven attributes (Boecker & Schweikl, 1988). Those attributes that are ‘very important or relevant to most respondents’ are used in studying consumer preferences for products (Green & Srinivasan, 1978, p. 117). Previous research has documented the evaluative criteria relevant to apparel consumers in a variety of situations and for a number of products. Analysis of twenty five studies of evaluative criteria for men’s, women’s and children’s apparel products identified thirteen product criteria, summarized in Table 1, consistently used by apparel consumers (May-Plumlee, 1999; May-Plumlee & Little, 1999). The analyzed studies represented a cross section of market segments and a variety of cultures suggesting that these evaluative criteria are relevant to most market segments. Most of these criteria are intrinsic (inherent in the product) except for price and brand that are extrinsic (added on by manufacturer or retailer). Intrinsic criteria are directly affected by design and development decisions. Color and fabrication reflect individual product attributes, while style/design/ uniqueness results from a combination of attributes. In practice, the relationship between the remaining intrinsic criteria identified in Table 1 and specific product attributes could be discerned through the use of market research strategies such as focus groups, surveys and wear tests. In all cases, understanding of consumer preference for the specific product attributes affecting how consumers evaluate product based on these criteria could facilitate product design and development.

**Table 1.**

**Universal product evaluative criteria**

| <i>Extrinsic criteria</i> | <i>Intrinsic criteria</i>     |
|---------------------------|-------------------------------|
| Brand/ Label              | Color/ Pattern                |
| Price                     | Style/ Design/<br>Uniqueness  |
|                           | Fabrication                   |
|                           | Care                          |
|                           | Construction                  |
|                           | Durability                    |
|                           | Fit / Sizing                  |
|                           | Fashionability                |
|                           | Quality                       |
|                           | Appearance/<br>Attractiveness |
|                           | Comfort                       |

Source: (May-Plumlee, 1999)

**Research approach and sector profile**

A survey of consumer purchases of women's bras was completed for this exploratory study. This product category was selected for several reasons. First, bras are a personal product with critical fit, so most customers purchase for themselves minimizing outside influences on the purchase decision. Second, limited design variation allows products to be described using a relatively brief list of specific product attributes. Third, over 75% of the bra market is consolidated in the product offerings of four manufacturers facilitating manufacturer level analysis (Friedman, 1998; Monget, 1995). Fourth, vendor managed inventory of product is common in the bra category, so vendors have access to an abundance of purchase data enhancing relevance of the results. Finally, the process

of managing a product line in the bra category is particularly complicated due to the stock keeping unit (SKU) intensive

nature of the category. One style requires multiple SKUs. For example, a bra may be available in six band sizes, four cup sizes and three colors, producing seventy-two separate SKUs for *one style*.

Because an SKU number recorded at point of sale corresponds to a specific product, aesthetic and technical design attributes of the product can be quantified by a manufacturer. With this in mind, a checklist was developed for recording attributes of purchased products including those related to the universal product intrinsic criteria. In addition to recording style number, color and size for purchased bras, the checklist was used to note product fabrication, general structure, cup structure, strap style and closure.

Data was collected for a two-week period in October 1998 in a southeastern department store situated in a regional mall next to a convention center. During this period, every bra on the sales floor was on sale during all but the last 3 days of data collection. A total of 272 bra purchases by 170 female consumers were recorded. Significant variation was found in the attributes of the products purchased, both when attributes were analyzed overall and also separately by the manufacturer (May-Plumlee, 1999). In the current research, charting techniques were used to examine variation in attributes of purchased products over time and among manufacturers. Additionally, this research examines the potential for forecasting attributes from product purchases. The attributes of color, fabrication, and design were examined including strap type, strap placement, strap adjustment, general structure, cup type, and padding. It will be noted that these are the three intrinsic attributes most often cited in studies and shown in Table 1.

**Results**

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The five most frequently purchased brands accounted for 79.5% of the 272 bra purchases. In addition, 96.4% of the bras came from four manufacturers. Examining purchases by style number, as is commonly done in industry, proved uninformative as 130

different style numbers were purchased. Nearly half of the style numbers, 49.2%

**Table 2. Colors of products**

|              |             |
|--------------|-------------|
| White        | Brown       |
| Black        | Taupe/ Fawn |
| Nude         | Grey        |
| Print        | Champagne   |
| Ivory/ Cream | Fashion     |

(n=64) , were purchased just once and only a dozen were purchased more than five times. Consequently, a product attribute analysis was undertaken.

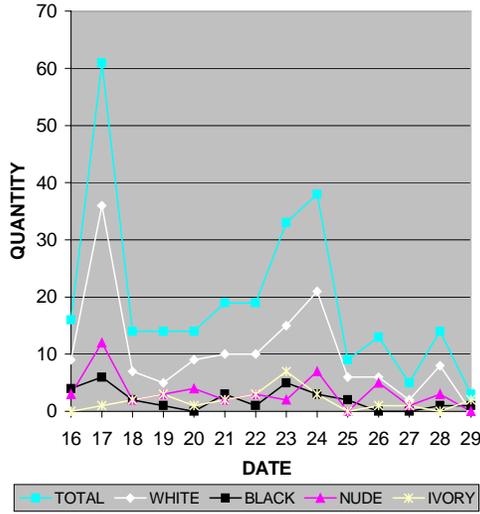
*Tracking attributes over time*

Each attribute recorded was plotted over time to explore purchase patterns for the two-week period studied. Results of the analysis of color (n=272) and fabrication (n=268) of the bras purchased are shown in

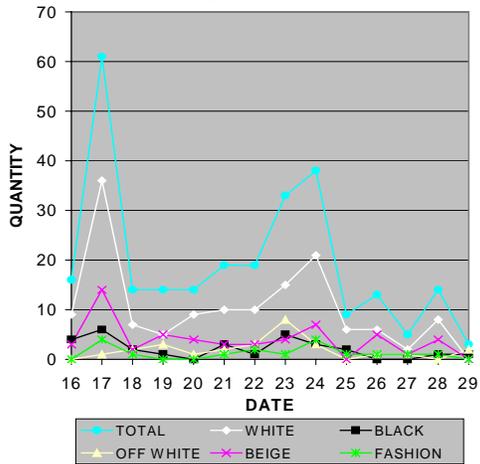
Figures 1a through 2c. Table 2 lists the colors of the purchased products. Figure 1a shows the number of bras of each of the top 4 colors purchased each day. This strategy for looking at the attribute of color makes it easy to see that white was the predominant color purchased. In Figure 1b, colors were grouped into color families, and all of the colors presented in Table 2 were included. In this figure, the importance of fashion as well as basic colors becomes apparent. In Figure 1c, color groups are charted as a percentage of total sales each day. This way, purchase patterns can be examined without the variation that results from differing numbers of daily purchases and from the generally declining trend in total purchases per day that occurred over the period of the study. Examined this way, beige seems to be a more important color group. However, an analysis based on percentages must be undertaken with caution because misleading patterns can result when the number of purchases is very small. For example, a dramatic change in color preference on the 29<sup>th</sup> is suggested by Figure 1c until one realizes that only three purchases, two to one consumer, are reflected in the chart.

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**Figure 1a. Frequently purchased colors**



**Figure 1b. Color groups**



**Figure 1c. Color distribution**

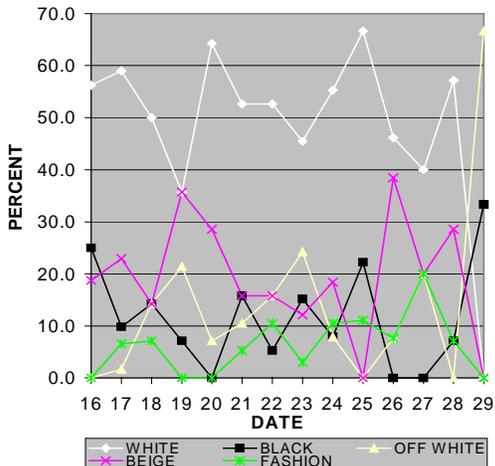


Table 3 presents the fabrications of all of the products purchased. Figures

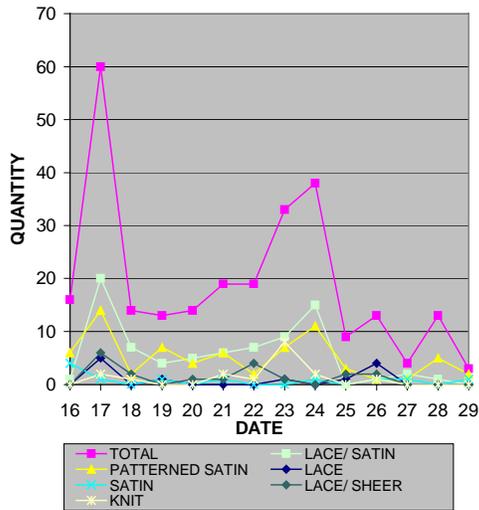
**Table 3. Fabrications of products**

|                 |                       |
|-----------------|-----------------------|
| Lace            | Part lace             |
| Patterned satin | Satin                 |
| Sheer           | Velvet                |
| Cotton          | Embroidered satin     |
| Satin/ Sheer    | Lace/ Sheer           |
| Lace/ Satin     | Embroidered sheer     |
| Lace/ Cotton    | Knit                  |
| Satin/ Knit     | Lace/ Patterned satin |
| Lace/ Knit      | Sheer/ Knit           |
| Other           |                       |

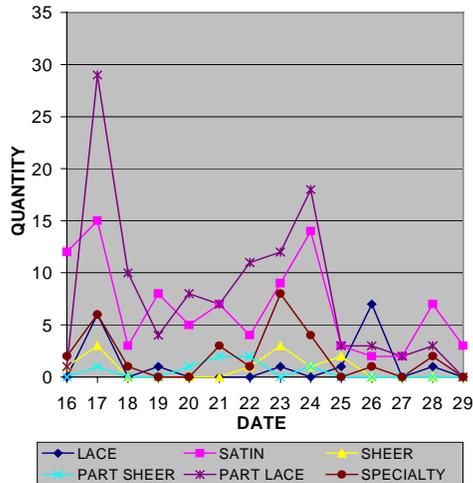
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2a-2c examine fabrication as a product attribute. Figure 2a illustrates that lace with satin and patterned satin dominate when individual fabrications are plotted over time. In Figure 2b, purchases are grouped according to similarities in fabrication, and preference for products featuring some lace is clear. As with color, grouping products by shared fabrications helped to tease out similarities in the attributes of purchases. In 2c, the importance of both satin and lace are clear, and an interesting change over time can be seen in the purchases of bras fabricated entirely in lace. In Figure 2c, days with fewer than ten purchases were dropped from the analysis to reduce the disproportionate influence seen in Figure 1c. Also, a trend line was added to illustrate the general change in the quantity of lace bras purchased over the two weeks studied. Although two weeks is too short a time to assume that an increase in preference for lace bras is occurring, the chart does demonstrate the potential of the technique for identifying trends in preferences for attributes.

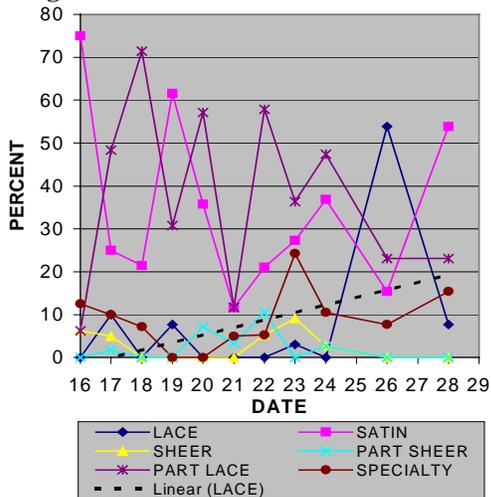
**Figure 2a. Most purchased fabrications**



**Figure 2b. Fabrication groups**



**Figure 2c. Fabrication distribution**



*Variation among manufacturers*

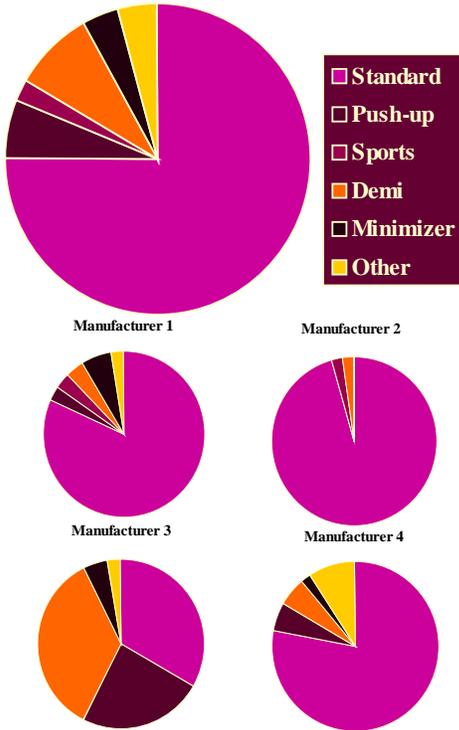
To examine the differences in attributes of purchased products among manufacturers, the two weeks of purchase data were examined overall. Figures 3 and 4 provide examples of the results of this analysis. The attributes of strap type (n=263) and general structure (n=269) related to the universal criteria of style/ design provide examples of this analysis. Note that differences can be seen in the attributes of the purchased products when broken down by manufacturer. For manufacturers, exploring purchase data for an entire category, as well as for their own lines, can provide additional information regarding opportunities for new products. However, considering foundation garments as a category for category management would yield aggregate POS data that would disguise these manufacturer differences.

*Forecasting attributes*

Currently most firms rely on style numbers to track product sales, sell through and to plan the product offerings for future seasons. This work investigates forecasting consumer purchases based on attributes of products purchased. This type of data analysis is not presently undertaken by either commercial market research firms or by manufacturers. Consequently, much information regarding consumer preferences is ignored by the current practice of tracking style numbers.

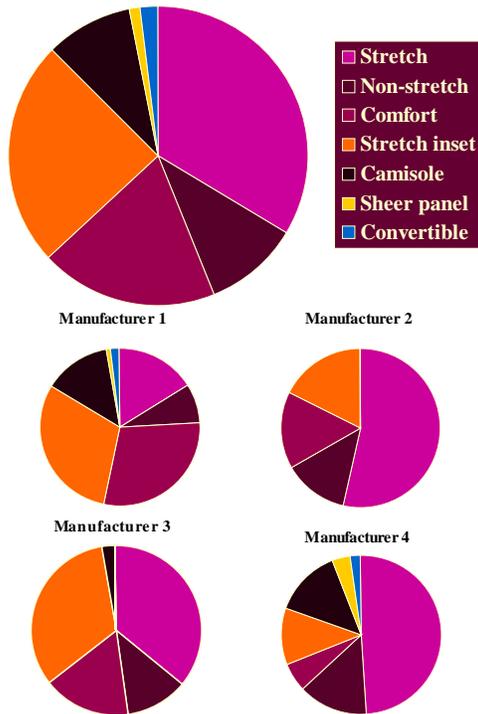
Figures 5 - 8 examine the potential for forecasting attributes for new product development. The assumption is made that purchase patterns were established by the end of the two-week period in which data was

**Figure 3. General structure**



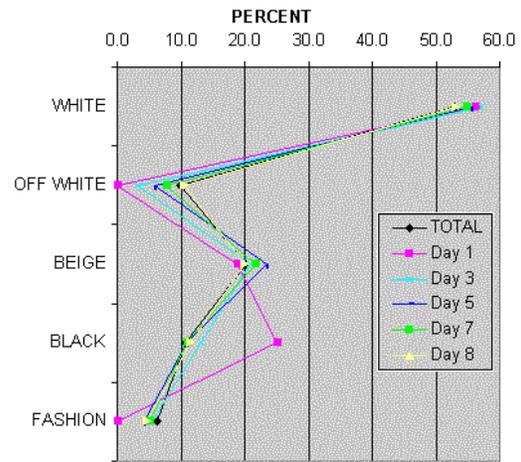
collected. Attributes examined were typical

**Figure 4. Strap type**

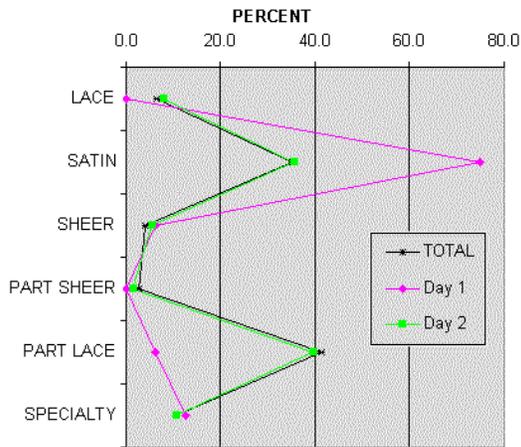


of apparel products and included color, fabrication, and a number of design attributes. Each of the figures shows the percentage of each attribute purchased at two weeks (TOTAL) and at intervals during the data collection period. It can be seen in Figure 5 that the percentage of each color purchased can be accurately predicted after the eighth day of purchase. Fabrication of purchased bras was accurately predicted after only two days, as seen in Figure 6. Prediction of purchases related to specific style features required up to 9 days, as seen in Figures 7 and 8. As can be clearly seen in each of the figures, a very strong indication of the attribute distribution is achieved after only 3 days. The data required to predict purchases by attribute appears to be somewhat indirectly related to the dominance of one option within that attribute; that is, when one option is represented in half or more of the purchases, more data is needed to characterize overall attribute distribution.

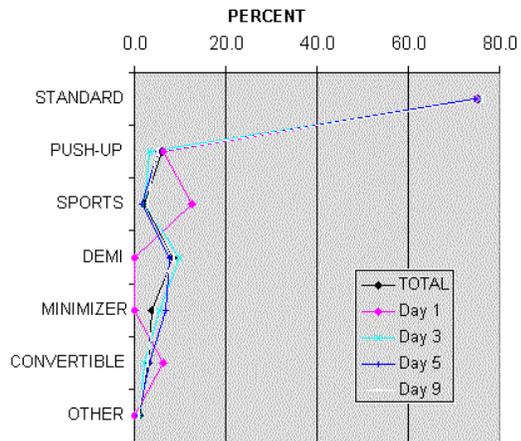
**Figure 5. Cumulative color distribution**



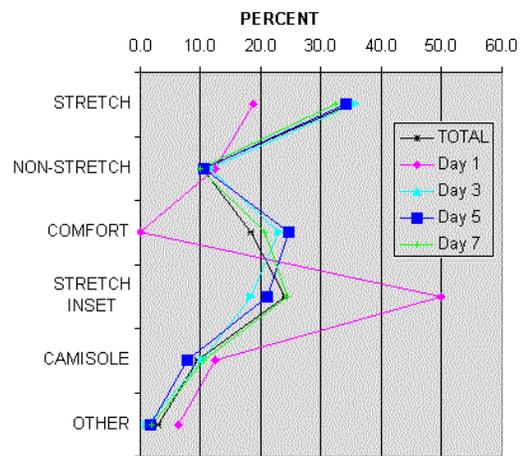
**Figure 6. Cumulative fabrication distribution**



**Figure 7. Cumulative structure distribution**



**Figure 8. Cumulative strap type distribution**



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Discussion**

Results of the current research suggest that gaining insight into consumer preferences for particular products via analysis of style numbers has limited potential. Consumers' style/ design preferences are not easily discerned by simply tracking the style numbers of products purchased. Although POS data provides a complete record of style numbers sold in nearly all cases, the huge array of different style numbers purchased creates challenges in interpretation. A vast amount of data would be required to identify style preferences and, even then, an understanding of characteristics shared by the purchased products would not be achieved. Presently, manufacturers generally do not track products according to attributes. Developing a database of style attributes for purchase preference analysis and for developing new products would be beneficial.

Results also suggest that the usefulness of purchase data for studying consumers' style/ design preferences may be improved by tracking and analyzing the attributes of purchased styles. For manufacturers, analysis of attributes would provide insight into product features that

were most widely purchased. Data from multiple retail outlets would show differences in attributes of preferred styles across geographic and demographic consumer groups. Over a long period of time, changes in preference for attributes could be identified, as suggested by Figure 1c. Analysis of product attributes could provide an ongoing sense of consumer preferences, of changes in those preferences over time, and could assist in making product and product mix decisions during product development. Combining data from different retail outlets would facilitate analysis and targeting product during development.

Purchases can be forecast by attributes with little more than a week of data, in some cases less. Additionally, only three days of data provide a very strong indicator of the attributes of upcoming purchases. This attribute forecasting would provide adequate time for manufacturers and suppliers to optimize sales by changing the product and color mix based on the sales data shared by retailers.

Each strategy for examining attributes of purchased products holds the potential to yield new and meaningful insight. The value of examining attributes in a variety of ways is illustrated by the examples in Figures 1 - 8. For an analysis similar to that shown in Figures 1a - 2c, many additional attribute groupings could be examined before conclusions were reached regarding specific trends. In this case, for example, all products containing satin could be grouped. Or products with lace components could be compared to those without.

If product attribute data is analyzed in aggregate for a category, even more insight into consumer purchase behavior is achieved, as illustrated by Figures 3 and 4. Currently, this is not done. Through investment in resources that provide category-wide data development opportunities in color and size could be

identified. An example of such a resource is SportsTrendInfo that provides weekly SKU specific POS data for the active and athletic wear segments, (Conrad, 1999).

An increasing number of manufacturers are working with retailers in vendor managed inventory (VMI) programs (Mautner, 2001). Companies with VMI programs should be able to analyze purchases and provide style and attribute data to the merchandising and product development functions. Retailers could use the information to order additional merchandise featuring specific attributes, or to jointly develop new product with their suppliers.

The potential applicability of POS purchase data for bringing input from the consumer into the product development process as described above moves consumers from multiple markets much closer to the manufacturer. In an increasingly global marketplace, POS data may provide a means of acquiring input from consumers in distant markets, particularly since there is evidence to suggest that the apparel purchase decision process is similar across cultures (Wagner & Ettenson, 1989). Use of POS data may help manufacturers to more easily adapt product lines for diverse markets.

## References

- Boecker, F. and Schweikl, H. (1988), "Better preference prediction with individualized sets of relevant attributes", *International Journal of Research in Marketing*, Vol. 5, pp. 15 - 24.
- Bonner, S. (1996, March), "Forecasting fashion", *Apparel Industry Magazine*, Vol. 57 No. 3, pp. 32, 34.

Conrad, A. (May 1999). "Designing for demand: SCM dream or reality", *Apparel Industry Magazine*, SCM-6 – SCM-11.

Engel, J., Blackwell R., and Miniard, P. (1995), *Consumer Behavior* (8th ed.). The Dryden Press, Fort Worth, TX.

Friedman, A. (1998, October 5), "NPD: Price, brands drive bra sales", *Women's Wear Daily*, Vol. 176 No. 65, p. 9.

Green, P. and Srinivasan, V. (1978), "Conjoint analysis in consumer research: Issues and outlook", *Journal of Consumer Research*, Vol. 5, pp. 103 - 123.

Irastorza, J. and Way, D. (1996, March), "VMI is for fashion, too", *Apparel Industry Magazine*, Vol. 57 No. 3, 16.

Mason, B. (1995, October), "Data mining: Exploring the unknown", *Discount Merchandiser*, Vol. 35, No. 10, pp. T58-T60.

Mautner, N. (2001, March 1-15), "Retailers rely on suppliers for inventory management", *Inside Fashion*, Vol. 11, No. 5, p. 4.

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

May-Plumlee, T. & Little, T.J. (November 1999). "Universal and Bra Consumers Evaluative Criteria", *International Textile and Apparel Association Proceedings*, p. 84.

Monget, K. (1995, May 15), "Big 4 bra firms take lion's share of the market", *Women's Wear Daily*, Vol. 169 No. 93, pp. 2,8.

Wagner, J. and Ettenson, R. (1989), "Apparel purchase decisions: A cross-cultural comparison of Chinese and American consumers", *Association of College Professors in Textiles and Clothing Proceedings*, Vol. 46, p. 121.

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