# USAGE OF COMPUTER TECHNOLOGY IN FABRIC MATERIALS PURCHASING BY LARGE-SIZE APPAREL MANUFACTURING FIRMS

by

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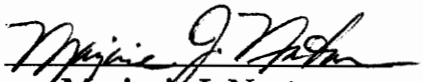

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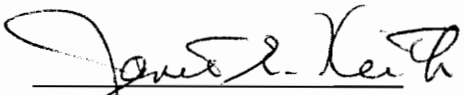

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## (ABSTRACT)

The purpose of this study was twofold: (a) to examine the fabric materials purchasing process of apparel manufacturing firms and (b) to determine the relationship between selected organizational factors of apparel manufacturing firms, firms' usage of computer technology in the fabric materials purchasing process, and firms' purchasing performance. The type of purchasing situation (i.e., new buy, modified rebuy, straight rebuy) among apparel manufacturers, was determined and was hypothesized to be related to usage of computer technology in fabric materials purchasing process. The selected organizational factors: product characteristics, centralized purchasing, and vertical coordination were hypothesized to be related to usage of computer technology in fabric materials purchasing process. Usage of computer technology was hypothesized to affect firms' purchasing performance. The conceptual framework for this

study was based on the Robinson, Faris and Wind (1967) buygrid framework; Rogers adoption theory (1983); and the Noordewier, John, and Nevin (1990) empirical work. A factor approach was used to examine a cross-section of firms to determine significant characteristics influencing computer technology usage.

The sample consisted of 118 apparel manufacturers. The "Top 100 Sewn Products Companies '95" published in the Apparel Industry Magazine, and Dun's Business Rankings 1995 constituted the source for the sample. The questionnaires were pilot tested with purchasing managers of two large-size apparel manufacturing firms, and also with a group of secretaries at Virginia Tech. Regression, Analysis of Variance , and Correlation were used to test the statistical significance of hypothesized relationships.

The relationship between type of purchasing situation and usage of computer technology was significant. Both straight rebuy and new buy situations were related to usage of computer technology. Demand uncertainty, as a measure of product characteristic, was significantly related to usage of computer technology. The relationship between usage of computer technology and purchasing performance was significant for possession cost and invoice cost as measures of purchasing performance.

**Dedicated to my family**

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## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

# CHAPTER I

## Introduction

### Background

The U. S. apparel industry is characterized by changing products and fashion. The life cycle of many apparel products is short and demand is volatile, with moderate to high uncertainty in demand. Speed and responsiveness can be used as a strategy for differentiation and establishment of a competitive edge by apparel manufacturers and retailers alike. Faster, more responsive vendors can outperform low cost but slower sources (Gilreath, Reeve & Whalen Jr., 1995). Today, an increasing number of apparel manufacturers are adopting the Quick Response (QR) business strategy coupled with Just-in-Time (JIT) manufacturing and purchasing strategies to meet the demands of their customers quickly. The adoption of computerized purchasing systems can help in fully implementing the QR and JIT manufacturing and purchasing strategies by transmitting purchase orders instantaneously, by expediting orders, and by providing small order flexibility (DesMarteau, 1995).

The buying process of many industrial organizations has undergone fundamental changes with the use of computers for purchasing materials and supplies, keeping current inventory figures, and computing economical order

quantities (Corman, 1990; Kotler, 1983). Electronic ordering provides computer to computer linkages between firms, enabling them to exchange business information, conduct purchase transactions, and send invoices and inter-company documents (Kotler & Armstrong, 1994). These systems eliminate manual and clerical work in business processes, thereby eliminating the need for paper work and high personnel requirements. Slow responsiveness to consumers also can be eliminated, because firms can instantaneously process and deliver orders. In addition, the concepts of inventory reduction and cost effectiveness can be realized by the adoption of electronic ordering. Stronger business partnerships can be formed between firms, because communication is facilitated.

With improved purchasing technology, organizational buyers are in a better position to make intelligent decisions, because they can carefully analyze their buying decisions (Corman, 1990). Computers also are used to assist buyers in making informed vendor selection decisions through the use of an automated database. The performance of the vendor and the buyer can be evaluated by the data in the computer. With increased competition, where suppliers often rate equally on price, quality and service, the suppliers who offer technological linkage have a greater propensity to be selected by the buyers (Hutt & Speh, 1992; Miller, 1992). Proper timing of delivery and expediting of the purchase

order, which are very important elements in buying, can be handled well by the use of computers in purchasing.

Although the apparel industry has been characterized by relatively simple technology since its evolution, the industry today is experiencing innovations in its production processes with the use of computer aided design (CAD), computer aided manufacturing (CAM), and Unit Production Systems (UPS). Management functions such as maintaining payroll and billing can now be computerized, and a closer link between the production and marketing chains is possible with the use of computers and automation (Dickerson, 1991). The purchasing functions of the apparel manufacturing and retailing industry also are being computerized with the adoption of Electronic Data Interchange (EDI) and by automation of the ordering process.

Despite the increases in available technology and proven savings in other industries (Hutt & Speh, 1992), adoption of computerized purchasing technologies among apparel manufacturers remains low. The usage level of computer technology in the apparel industry for materials purchasing remains undetermined. The organizational factors that affect the adoption of such technological innovations need to be examined to promote automation of the purchasing process in the apparel industry.

Changing technology can restructure an industry and can dramatically alter organizational buying plans (Hutt & Speh, 1992). The purpose of the present research is twofold: (a) to examine the fabric materials purchasing process of apparel manufacturing firms and (b) to determine the relationship between selected organizational factors of apparel manufacturing firms, firms' usage of computer technology in the fabric materials purchasing process, and firms' purchasing performance.

The contribution of this research is both analytical and empirical. The analytical contribution is that the research will provide a guideline to managers and decision makers in formulating procurement policies and purchasing strategy and in selecting suitable buying techniques in today's age of automation and technology.

The empirical contribution is that this research can be used as a starting point to examine related issues in purchasing in the apparel industry. Although some studies in the past have been conducted focusing on apparel retail buying practices, researchers have not addressed the issue of purchasing from the manufacturer's perspective.

## The U. S. Apparel Industry

### Structure

The apparel sector is a large and distinct segment of the U. S. industrial base. The apparel industry is closely tied to the textile industry and is a part of the textile complex. Despite the fact that the textile and apparel sectors have a great deal in common as a part of an integrated production and marketing chain, each has distinct characteristics and unique problems (Dickerson, 1991). The apparel industry is extremely labor intensive, is the most fragmented sector within the textile complex, and is characterized by many small firms employing an average of 47 workers per establishment (Office of Technology Assessment, 1987). An establishment is defined as a single physical location where business is conducted or where services or industrial operations are performed (Office of Management and Budget, 1987). In the year 1987, more than 15,000 firms operated 22,872 establishments (U. S. Bureau of Census, 1994). There are few entry barriers to the apparel industry in terms of capital and technical knowledge requirements, access to production equipment, and availability of raw materials (National Research Center, 1983).

Apparel manufacturing can be classified by three types of production operations: (a) manufacturers, (b) jobbers, and (c) contractors (Dickerson, 1991). Manufacturers are responsible for a number of operations ranging from

designing to shipping. Jobbers may do their own designing but almost never perform any sewing operations, which are done by employing contractors. Contractors are independent producers engaged in sewing operations. They receive cut fabrics that are to be sewn into garments. Distinctions between the three types of production operations are based on their respective functions and ownership of: (a) title to the product and (b) production facility (see Table 1).

**Table 1**
**Distinction between the Three Types of Production Operations**

| *Production Operations* | *Functions* | *Ownership of title to product* | *Ownership of Facility* |
|---|---|---|---|
| **Manufacturers** | Design/Manufacture | Yes | Yes |
| **Jobbers** | Design | Yes | No |
| **Contractors** | Manufacture | No | Yes |

Each type of production operation has both advantages and disadvantages (Dickerson, 1991). While manufacturers assume greater control over the production processes, they suffer from reduced flexibility because of large investments in capital and labor force. By contracting out some of the production operations, manufacturers can gain flexibility to expand output without added investment in equipment; however, the manufacturers may lose some control over the quality and delivery dates.

## Product Types

Apparel products can be classified according to their product categories (Office of Technology Assessment, 1987) and product lines (Glock & Kunz, 1990; Johnson & Hill, 1978; Ko, 1993; Lin, Kincade, & Warfield, 1995). Apparel production includes the manufacture of men's, boys', women's, girls', and infants' apparel and apparel accessories (Office of Technology Assessment, 1987). Items are produced by cutting and sewing woven, knitted, and other less prevalent textile fabrics. Typically, an apparel firm produces a narrow product line. However, larger firms may produce garments in more than one category (e.g., women's outerwear, children's sleepwear, men's furnishings). In addition, garments produced by most firms fall within a fairly specific price and fashion range.

The two digit major group code assigned to the apparel industry under the Standard Industrial Classification (SIC) is SIC 23 (Office of Management and Budget, 1987). This two digit industry classification is divided into nine subgroups (see Table 2).

**Table 2**
**SIC Classification**

| *SIC Code* | *Apparel Categories* |
|---|---|
| **SIC 231** | Men's and Boys' outwear |
| **SIC 232** | Men's and Boys' furnishings |
| **SIC 233** | Women's and Misses' outwear |
| **SIC 234** | Women's and Children's undergarments |
| **SIC 235** | Millinery |
| **SIC 236** | Children's outwear |
| **SIC 237** | Fur goods |
| **SIC 238** | Miscellaneous apparel and accessories |
| **SIC 239** | Miscellaneous fabricated textile products |

Each additional digit added to the major group code signifies further subcategorization within the apparel products (e.g., SIC 2331 represents women's and misses' blouses; SIC 2337 represents women's and misses' suits, coats, and skirts). SIC categorizations are based on gender, age category, and end use of the apparel item.

Johnson-Hill (1978) classified apparel products into four types of product lines: staple, semi-staple, fashion, and high-fashion. This classification is based on the volume of production, degree of style variation, and frequency of style changes. Lin, Kincade, and Warfield (1995) further develop the classification provided by Johnson-Hill (1978) by operationalizing the 'frequency of style

changes', 'degree of style variation', and 'volume of production' variables. The volume of production is expressed as dozens of units of a style per season, and a season is equivalent to 13 weeks. Degree of style variation refers to the variation that occurs between the first and the subsequent styles. The frequency of style change is expressed as the number of style changes occurring per season. The latter ranges from zero to six style changes for the categories of product line.

Glock and Kunz (1990) group apparel products into fashion and season based on style and demand variation, respectively. Fashion goods are products that demonstrate a continuous demand for change in styling. Style is defined as a distinctive feature or characteristic of a garment. Seasonal change refers to changes that products exhibit in the market demand based primarily on the time of the year. This grouping of apparel products into fashion and seasonal is not categorical, but represents a continuum: Basic/Fashion continuum and Staple/Seasonal continuum. Table 3 represents a perceptual map of product change.

**Table 3**
**Perceptual Map of Product Change (Adapted from Glock & Kunz, 1990)**

| | |
|---|---|
| *Sector 1*<br>Basic/Staple | *Sector 2*<br>Fashion/Staple |
| *Sector 3*<br>Basic/Seasonal | *Sector 4*<br>Fashion/Seasonal |

Sector 1 represents products that are basic and staple. Basic product is defined as products that change very little in styling between one season or year and the next. Staple product is defined as products that are in continuous demand throughout the year. Sector 2 represents fashion and staple products. Sector 3 depicts basic and seasonal products. Sector 4 depicts fashion and seasonal products. The frequency of style changes in the apparel products reflects the uncertainty in the characteristics and composition of apparel product mix as demanded by the market. Unanticipated changes in the forecasted volume requirements and the mix of items needed depict the uncertain external environment in which the apparel firms must operate. Firms operating in Sector 1 should have the least amount of uncertainty, and firms operating in Sector 4 would experience the greatest amount of uncertainty.

## Technologies

Technology within the apparel industry can be applied to three broad functional areas: design, manufacturing, and management (Byrne, 1995). This categorization is based on the typology of innovations (Ettlie & Reza, 1992; Hassan & Scott, 1991; Kimberley & Evaneski, 1981), and can be grouped as product (design), process (manufacture), and administration (management) innovations.

**Technologies in Design.** Computer-aided-design systems (CAD) expedite the design process. Superior products and focused product lines can be accomplished by using CAD systems, which allow an increased amount of creativity (Van De Bogart, 1988). Manufacturers and retailers alike can create, preview, and alter the designs for apparel lines without expending time and money to produce garment samples. Computerized design images can next be translated into fabrics and pattern shapes, which can then be marked and cut for production purposes (AAMA, 1987; AAMA, 1991; Van De Bogart, 1988).

**Technologies in Manufacture**. Advancements have been made in the areas of spreading, marking, and cutting; sewing and assembly; and pressing (AAMA, 1992). These three areas constitute the major stages in apparel manufacturing. Cutting can be accomplished by a metal blade, a laser beam, plasma gas, or water jets (AAMA, 1987; AAMA, 1992; Byrne, 1995). The S-91

HPC (high ply cutter) of Gerber Garment Technology is a significant improvement in cutting technology, which reduces weight and vibration in cutting. In addition, Gerber offers S-93 MPC (medium ply cutter), and S-95 LPC (low ply cutter). Other improvements include the Knife Intelligence systems, the Operator Command Console, Ribbon Cabling and Time Management systems (Hwang, 1993). These systems allow for rapid, single ply, hands free cutting, which provides flexibility and accuracy for the manufacturer.

The apparel assembly process has undergone changes with the use of UPS systems. The usage of overhead conveyers to carry garments from one operation to another with programmed instructions has been of interest to every apparel manufacturer (AAMA, 1987). Modular manufacturing is being applied to sewn products (Carrere & Little, 1989; Gaetan, 1986; Gilbert, 1990; Lowder, 1991; Mazzioti, 1993; Moynahan, 1993; Schroer & Ziemke, 1992). Computerized sewing and robotics are beginning to be applied to sewing and handling of parts between operations, respectively (AAMA, 1987). Mechanized pressing systems and carousel style machines replaced traditional pressing machines, which have evolved further with the introduction of microprocessor controls and automated unloading systems that combine pressing and fusing operations (Grogan, 1983; Grogan, 1986). Additional cutting, sewing, and pressing technologies are explained by AAMA (1992).

**Technologies in Management**. Although the concept of management is very broad, this discussion on technologies in management focuses only on communication and information technologies. Of all the technologies, communication and information technology such as Bar Codes, Point-of-Sales (POS), and Electronic Data Interchange (EDI), currently, present a major scope for improvement for the apparel industry (Byrne, 1995). EDI is defined as "the direct computer-to-computer exchange of standard business forms" (AAMA, 1992, p. 1). A more applied definition of EDI is "the direct application to application exchange of business documents in standard formats" (AAMA, 1992, p. 1). With EDI, business documents such as invoices, purchase orders, shipping notices, sales data, inventory data, UPC product information, and bills of lading can be transmitted over a public or private telecommunication network (Bert, 1989). Communication links for EDI can be established by private links that require customized communication software or by using a third party network to handle the transmission of information to other subscribers (Bert, 1989; Correia, 1993; 1994; Robins, 1988).

American National Standards Institute (ANSI) X12 Committee has developed several standard document formats which allow cross-industry exchange and can be used by any type of business to exchange a document (e.g., purchase order) with any other type of business. Industry groups, such as

Voluntary Inter-industry Communications Standards (VICS), the Textile Apparel Linkage Council (TALC), and the Sundries and Apparel Findings Linkage Council (SAFLINC), have used the ANSI X12 Committee standards and developed subsets of the document formats to be used by their business members. For example, the VICS standards define the documents that will be exchanged by the apparel manufacturers and their retail customers. The TALC standards define the documents that will be exchanged by the apparel manufacturers and their textile suppliers. The SAFLINC standards define the documents that will be exchanged by the apparel manufacturers and their suppliers of accessory items, such as findings. Even after accepting industry standards, translation softwares are needed to extract the information received on the computer, to translate the information from the standard format, and to integrate it into the company's in-house applications (AAMA, 1991; Bert, 1989).

# CHAPTER II

## Review of Literature

The review of literature is organized in three sections: (a) theoretical models of buyer behavior; (b) purchasing practices and procedures in U. S. apparel and other industries; and (c) adoption of technological innovation.

## Theoretical Models of Buyer Behavior

Decision making and purchasing behavior are closely tied to the theories of buyer behavior; therefore, it is appropriate to review the various theoretical models of buyer behavior that exert influence on varied purchasing situations. The models discussed below (Anderson & Chambers, 1985; Robinson, Faris, & Wind, 1967; Sheth, 1973; Webster & Wind, 1972) are representative of state of the art industrial buyer behavior models (Samli, Grewal, & Mathur, 1988).

### The Buygrid Framework

Robinson, Faris, and Wind (1967) developed a conceptual framework for analyzing industrial buying situations. They provided a taxonomy of buy situations and identified three types of buyclasses and eight buyphases. Phase 1 consists of the anticipation or recognition of a problem where the company

recognizes the need for acquiring a good. In Phase 2 the quantity of the needed item is determined. In Phase 3 the quantity of the needed item is described. Phase 4 is the search for sources from where the item may be procured. Phase 5 is the solicitation of the proposals. Phase 6 is the selection of the suppliers. Phase 7 is the selection of a routine order, and in Phase 8 the performance is reviewed. Depending on the particular buying situation, some of the buyphases are more important than the others.

The three types of buying situations, or buyclasses, identified by Robinson, Faris and Wind (1967), were new task, modified rebuy and straight rebuy. New task is defined as the purchase of items which have not been previously bought by the firm. Modified rebuy refers to items that are not bought on a regular basis. A straight rebuy refers to items that are purchased on a routine basis. These buyclasses differ from one another on the basis of newness of the problem, information requirements, and alternative considerations. New task situations are expected to be high on all these three dimensions, and a straight rebuy situation is low on all three dimensions. Modified rebuy is moderate on all three dimensions.

## Webster and Wind Model

Webster and Wind (1972) agreed with the classification of the buy phases described by Robinson, Faris and Wind (1967). In addition, they posited that organizational buying is influenced by four major factors: (a) environmental, (b) organizational, (c) interpersonal, and (d) individual. Within these broad factors, they developed a classification of task variables and nontask variables. The task variables were directly related to the organizational buying problem, and nontask variables were not directly related to the organizational buying problem (Webster & Wind, 1972).

**Environmental factors**. The task related environmental factors include economic, technological, political and competitive developments in the environment within which the company operates. Among all of these, the economic factors are of major importance and include price and wage conditions, level of employment, changes in demand, and availability of money and credit. The nontask related environmental factors include such social and cultural forces as government institutions, bank organizations, and transportation companies. These institutions form an integral part of the environment within which organizational buying decisions must take place (Webster & Wind, 1972).

**Organizational factors**. The task related organizational factors refer to the objectives, policies and procedures, and technical and delivery requirements of

the organization. These factors influence the decision making process of a formal organization. Furthermore, the system of rewards, power system, and authority also exercise an influence on decision making process, but indirectly as non task related factors (Webster & Wind, 1972).

**Interpersonal factors**. Industrial buying decisions involve several members of the organization. These individuals, who are a part of the decision making process, compose the buying center. The concept of buying center is central to the study of organizational buying behavior. A buying center consists of all the individuals who participate in the decision making process (Berkowitz, 1986; Crow & Lindquist, 1985; Jackson, Keith & Burdick, 1984; Patton, Puto & King, 1986). The buying center consists of influencers, users, deciders, buyers, and gatekeepers. Influencers do not have power to decide what to buy, but they can exercise influence by applying constraints. Users do not have any buying authority, but they can make suggestions about the required purchase materials. Deciders have the power to select between alternative brands and vendors. Buyers are the individuals who actually carry out the buying activity. Gatekeepers have an indirect influence on the buying process, because they can control the flow of information that is needed by the deciders to make purchasing decisions (Webster & Wind, 1972).

**Individual factors**. The individuals composing the buying center identify with the company objectives, act on behalf of the company, and can significantly influence buying decisions. The individual accepts the objectives of the organization as his own while also deciding that the organization represents the best opportunity to pursue his own objectives and satisfy his own needs. These objectives and needs are the task related factors that exercise influence on the buying decision making process. A buyer's age, income, personality, and preferences are some of the nontask related factors that are known to influence their buying decisions (Webster & Wind, 1972).

## Sheth Model

The Sheth (1973) model is a generic model which explains all types of industrial buying decisions. It describes joint decision making processes of industrial organizations. According to Sheth (1973), organizational buying behavior consists of three aspects. The first aspect consists of the psychological variables of the individuals involved in the decision making. The second aspect refers to the conditions that precipitate joint decision making. The last aspect is the process of joint decision making.

Sheth (1973) points out that the individual is not the only single factor involved in making buying decisions. In many situations, different departments

of the organization such as the personnel, quality control, and manufacturing departments are involved in the buying processes. Because a considerable amount of interaction goes on among these individuals, the similarities and differences in the psychological makeup of these individuals are significant. Several aspects of the psychology of decision makers, particularly the expectations of the decision makers, are included in the model. Differences in the expectations about suppliers and brands are affected by (a) the background of the individuals, (b) sources from where the information is received, (c) differences in perception, and (d) satisfaction with past purchases.

The nature of buying decisions is determined by and related to the product specific and company specific factors. The product specific factor refers to the perceived risk, type of purchase, and time pressure. If the magnitude of the risk involved in a purchase is high, it is likely that the buying decision will be taken jointly. Similarly, if the purchase involves a large amount of capital expenditure, the decision is likely to be a joint one. If a buying decision has to be made in an emergency, then it is likely that the decision made will be an autonomous one. The company specific factors refer to the company orientation, company size, and the degree of centralization. If a company is production oriented, it is likely that the buying decisions will be made by the production personnel. Similarly, the larger the size of a company, the more possibility there

is of making joint buying decisions within the company. The degree of centralization has an adverse effect on joint decision making possibility.

The Sheth (1973) model examines the process of joint decision making. Sheth points out that information gathering and information assimilation are very important for joint decision making process. Due to differences in expectations of the members involved in decision making, conflict is bound to occur, and it can be resolved by problem solving (i.e., gathering further information), persuasion (i.e., persuading the dissenting member to agree), or bargaining (i.e., allowing a single party to make independent decisions on a reciprocal basis).

**Anderson and Chambers Model**

Anderson and Chambers (1985) introduced the element of motivation in their model. They assert that reward and measurement systems exert tremendous influence on the buying process. The reward/measurement model consists of two submodels: motivational model and group consensus model.

**The Motivational Model**. The motivational model is based on the expectancy theory. The participants engaged in buying do so with the expectation of obtaining both intrinsic and extrinsic reward. Salary, promotions, and fringe benefits that are given by the organization to its members are the

extrinsic rewards. These extrinsic rewards are based upon external performance measurements. Intrinsic rewards, on the other hand, are those which are given to the individual by himself. These intrinsic rewards are dependent upon purchasing behavior and purchasing performance.

The purchase performance is considered to be a multidimensional construct and is measured by various indexes (Anderson & Chambers, 1985). Certain indexes can be measured more easily than others. For example, price concessions wrested from a vendor by a purchasing agent represent an easily measured and quantifiable index of purchasing agents' performance. However, the ill-will generated during the negotiation process is not easily measured or quantified. Therefore measured performance is a subset of the individual's total purchasing performance.

**The Group Consensus Model.** The group consensus model addresses the interaction process through which group consensus is achieved in conflict situations. Social influence, group rewards, coalition formation, and hierarchical decisions can play an important role in accomplishing group consensus in the buying center.

**Theoretical models: Their contribution and validity**

The buygrid model develops a useful taxonomy and makes testable propositions. Empirical studies have been conducted on the buygrid model to test its validity; however, there is no consensus of opinion among the researchers on the applicability of the model in buying decision making. Bellizzi and McVey (1983) found the buyclass variables (i.e., new task, modified rebuy, straight rebuy) to be nonsignificant in predicting the influence of individuals on industrial buying, although the importance of these variables was manifested in the amount of information sought in making purchase decisions. Others found the buyclass variables to exercise significant influence on the buying process (Anderson, Chu, & Weitz, 1987; Ginghold, 1986; Matthyssens & Faes, 1985). Information needs, consideration of alternative choices, and newness of the task were the dimensions studied for the three buy situations. New task was found to be high on all the three dimensions, and straight rebuy was low on all three dimensions. The modified rebuy was midrange on all the three dimensions.

The major focus of the Sheth (1973) model and the Webster and Wind (1972) model is upon description, definition, and categorization. These models have a major contribution to the field of organizational buying by influencing the ways in which researchers have structured their research problems and the manner in which variables have been defined and operationalized by researchers

(Anderson & Chambers, 1985). The Anderson and Chambers model (1985) provides a new way of conceptualizing the organizational purchasing process, makes concrete propositions, and generates empirically testable predictions that can be used to identify the model's strengths and weaknesses.

## Purchasing Practices and Procedures in Apparel and Other Industries

The discussion on purchasing practices and procedures proceeds from the generic (i.e., what is known about purchasing practices in some other industries) to the specific (i.e., what is known about purchasing practices in the apparel industry).

### The Purchasing Process

There are many differences in purchasing departments' organization and procedures not only between industries but also within specific industries. Despite the differences, the basic elements in a purchase transaction can be summarized (Bailey, 1981). There is general agreement in the purchasing and marketing literature on the stages of the purchasing cycle (Bailey, 1978; 1981; Hahn, Pinto, & Bragg, 1983; Heinritz & Farrel, 1971; LaLonde & Emmelhainz, 1985; Parasuraman, 1981; Robinson et al., 1967; Zenz, 1981). According to the cited authors a purchasing transaction takes the following cyclical form: (a)

recognition of a need, (b) determination and description of requirement, (c) selection of possible sources of supply, (d) determination of price and availability, (e) selection and placement of the order, (f) follow-up and expediting of the order, (g) receiving of orders, (h) verification of the invoice, (i) processing of discrepancies and rejections, (j) closing of completed orders, (k) maintenance of records and files, and (l) evaluation of performance. These stages are comprehensive and include most of the activities associated with the purchasing procedure.

In the apparel industry, the buying process that purchasing agents use is determined by a sequence of managerial decisions including preseason testing, sales forecasting, production planning, master production scheduling, and style assignment (Glock & Kunz, 1990; McPherson, 1987). Some firms have a central purchasing department which is responsible for all purchases: raw materials, capital equipment, tools, and supplies. Other firms have a decentralized purchasing system where purchasing powers are delegated to divisions or departments that are responsible for use of the item (Solinger, 1988).

Purchasing of raw materials in an apparel firm begins first with the establishment of quality specs and quantity requirements per style of raw material needed, from the departments of Design, Sales, and Production (Solinger, 1988). Specs refer to specifications and are of two types: static and

dynamic. Static specs pertain to the physical dimensions of the item and are also termed properties. Dynamic specs refer to the reaction of the item to a given strain or stress and are also termed stress and strain characteristics. The submission of sample swatches by the departments of Design, Sales, and Production is the next step in the purchasing agenda, and is followed by the arrival of sample cuts for quality control tests, and pilot models (Solinger, 1988). The delivery schedule of raw materials is then planned. A direct liaison is established with textile and trim vendors to establish a seasonal just-in-time delivery schedule. Some textile firms link with computers to apparel firms (McPherson, 1987; Solinger, 1988). A time lag is permitted between sending of purchase order and delivery of the order for making quality defect claims.

Purchasing practice of an apparel company is determined by its trading policies (Tyler, 1991). Based on its trading policy, a company can be described as: No Stock Company, Fabric Stock Company, and Garment Stock Company. No Stock companies make to contract, and purchasing and production are based on agreements contracted between customers and manufacturers. Fabric Stock companies anticipate customer contracts, purchase materials in anticipation of contracts and hold materials in stock. When contracts are confirmed, the manufacturer proceeds with the cutting and assembly operations. Garment Stock companies purchase raw materials, manufacture garments and hold

garments in stock. Garments are dispatched on receipt of a contract (Tyler, 1991). Accordingly, purchasing policies of these three types of companies can be categorized into purchasing system based on contracts (for no stock companies) and purchasing system based on sales plan (for fabric and garment stock companies). The two approaches to purchasing based on contracts and sales plan are indicated in Table 4.

**Table 4**
**Comparison of Two Approaches to Purchasing (Tyler, 1991)**

| *Contract Purchasing* | *Sales Plan Purchasing* |
|---|---|
| For No Stock Companies | For Fabric and Garment Stock Companies |
| No fabric surplus to requirements | Possible redundant stock |
| Lower average stock levels, to reduce capital requirements | Higher average stock levels, leading to higher costs |
| Unavoidable time delay between receiving contract and cutting | No significant time delay between receiving and cutting |
| Little flexibility | Greater flexibility |

Each of the two approaches discussed above has its strengths and weaknesses. While there is a significant time delay between receiving contracts and manufacturing for No Stock companies, Fabric and Garment Stock companies are more responsive to consumers in terms of speed. While the former incurs low storage costs and low risk, the latter has higher average stock

levels, higher storage cost, and also a higher risk because of the possibility of redundant stock.

## Purchasing Techniques

Various types of purchasing techniques exist between firms that aim to reduce the materials and administrative costs (Bailey, 1981; Heinritz & Farrel, 1971; Newman, 1985; Tyler, 1991; Zenz, 1981).

**Blanket Orders**. Blanket orders are agreements to purchase a specified quantity of goods and cover a specific period of time (usually 12 months). In apparel, specific time period refers to the whole or part of a season (Stone, 1987). Such orders also are known as bulk orders. Materials are called forward by the buyers, and by stating the bulk order number, materials are released by their suppliers as required. Prices are agreed upon, and if price is not specified, a method of determining it is made a part of the contract (Bailey, 1981; Groeneveld, 1972; Noordewier, 1989; Zenz, 1981). A blanket order simplifies the ordering process, because, instead of relying on the conventional purchasing order to obtain materials, the buyer uses a release form to notify the supplier as requirements arise. A blanket order saves time and money because it eliminates the need for repeated vendor evaluation and selection and for multiple purchase orders for supplies from different sources (Hannaford, 1983; Noordewier, 1989).

**Systems Contracting.** There is a structural overlap between blanket and systems contracts, because they possess such common characteristics as price flexibility and long duration of purchase agreement (Newman, 1985; Noordewier, 1989). Systems contracting, however, offers longer duration of purchase agreements and greater price flexibility. Although it may be difficult to distinguish between blanket and systems contracting, Noordeweir (1989) noted some important points of difference between the two ordering systems; systems contracts: (a) rely on periodic billing procedures in contrast to individual order billing procedures of blanket order, (b) require minimum inventory levels to be maintained by vendors, compared to blanket orders, and (c) do not specify the volume of items to be purchased by the buyer, compared to blanket orders.

**Stockless Purchasing.** Under such a system, the buyers are under no financial obligation to carry the inventory being purchased. The inventory is owned by the supplier, and the supplier assumes the inventory carrying and warehousing costs. In order for a stockless system to succeed, a good relationship between the buyer and supplier is vital with service being a critical component. The goods may be located either at the buyer's or the supplier's location. The term consignment buying is used if the goods are located with the buyer, and within a stipulated time the buyer can return unsold merchandise to the vendor (Heinritz & Farrel, 1971; Stone, 1987; Zenz, 1981). Items purchased at

frequent but irregular intervals are, in general, bought by using this stockless purchasing method.

**Small Order Procedures**. Items that are ordered in small quantities and are purchased infrequently are purchased by specialized techniques: (a) Petty-Cash system is a system that sets aside a fixed sum of money for minor expenses; (b) Cash on Delivery (COD) reduces any expenses associated with invoicing and accounts payable procedures; (c) Telephone Order is another form of ordering non-recurring small value purchases; and (d) Check Payment Ordering System combines the purchase order and a blank check for payment purposes. The product description, quantity, unit price, shipping instructions, and terms of payment are all included in the purchase order section (Heinritz & Farrel, 1971; Zenz, 1981).

## Just-in-Time Purchasing Strategy

The use of the just-in-time (JIT) manufacturing strategy has become widespread among American manufacturers since the concept was introduced in the United States of America in 1970. The JIT philosophy is comprised of three management thrusts: total quality assurance, total preventive maintenance, and JIT production management (Gilbert, 1989; John & Heriot, 1993). One of the first steps critical to the implementation of JIT is the adoption of a JIT purchasing

strategy (John & Heriot, 1993). Apparel manufacturers are increasingly making use of JIT inventory and lead time concepts to meet foreign competition. Since the system requires materials to be purchased as needed, the overall inventory level is reduced (Hahn, Pinto, & Bragg, 1983; Miller, 1992). Lead time reliability is greatly improved with shorter delivery lead time, contributing to reduced safety stock requirement among firms. Scheduling flexibility is also enhanced with reduced production and purchasing lead times, enabling the firm to respond to any shifts in market demand (Billesbach, Harrison, & Morgan, 1991; Dion, Banting, & Hasey, 1990; Hahn, Pinto, & Bragg, 1983; John & Heriot, 1993). High and consistent material quality, a top priority in JIT, can be improved by JIT purchasing (Schonberger & Ansari, 1984).

Linkage is the term sometimes given to JIT because it promotes long-term cooperation-oriented relationships instead of competitive adversary-oriented relationships between trading partners (Hahn, Pinto, & Bragg, 1983; O'Neal, 1989). By developing cooperative relationships with the suppliers and by integrating the entire supply channel, the supplier base is reduced and leads towards a single or single/dual sourcing policy (Billesbach et al., 1991; Gentry, 1991; Manoochehri, 1984).

Purchasing situations are subject to different types of risks and uncertainties (Tullous & Munson, 1991). Gatignon and Robertson (1989) refer to

demand uncertainty, which is a part of a broader concept of environmental uncertainty as proposed by Lawrence and Lorsche (1967) and Duncan (1972). Demand uncertainty is defined as the difficulty experienced in predicting demand. Other types of uncertainties faced by industrial purchasers are: need uncertainty, market uncertainty and transaction uncertainty (Tullous & Munson, 1991). Need uncertainty overlaps with demand uncertainty and is defined as the ease or difficulty in determining a product's characteristics and uses. Market uncertainty is defined as difficulty encountered in comparing the characteristics of potential suppliers. Transaction uncertainty is defined as the degree of difficulty encountered in delivering the product to the purchaser.

JIT manufacturers are faced with different types of environments based on the certainty and uncertainty of demands (John & Heriot, 1993). These environments have implications for the selection of suppliers by JIT buyers. When the dominant competitive pressure is low cost coupled with certain demand, large suppliers may achieve cost benefit from economies of scale. When the dominant competitive pressure is low cost coupled with uncertain demand, small suppliers can offer schedule flexibility. When the JIT manufacturer faces certain demand and delivery competitive pressures, small potential suppliers to it may have few opportunities to distinguish themselves. When demand is uncertain and delivery pressure is high, small suppliers are

suitable. Characteristics of the environment of JIT manufacturers and purchasers are summarized in Figure 1.

| | *Certain Demand* | *Uncertain Demand* |
|---|---|---|
| Low Cost pressures | A | B |
| Delivery Pressures | C | D |

CHARACTERISTICS OF JIT MANUFACTURERS' ENVIRONMENTS - DEMAND PATTERN VERSUS KEY COMPETITIVE PRESSURE
Figure 1

Most apparel manufacturing firms can be identified with the B and D situations explained in the matrix, where demand for their products is uncertain and is coupled with both low cost competitive pressure and delivery competitive pressure. Apparel firms are faced with varying degrees of unanticipated changes in their forecasted volume requirements and in the mix of needed items and functions under conditions of high demand uncertainty because of the unpredictability of demand experienced for most apparel items.

**Use of Computers in Purchasing**

Purchasing departments are making greater use of computers. Parasuraman (1981) found that 53% of a sample of purchasing function employees used computers in some aspects of purchasing activities. Lalonde and Emmelhainz (1985) found an increase in computer use by purchasing personnel. A 1987 survey by Purchasing Magazine found that 88% of purchasing personnel used computers for some aspect of their work. Plank, Reid, Kijewski, and Lim (1992) examined the use of computers by purchasing departments and reported 98.2% usage rate for computers. Computers were used mainly to maintain inventory records and vendor lists and to monitor purchase orders, but had limited use for material resource planning (MRP), analyzing vendor ratings, and selecting vendors (Parasuraman, 1981).

A computer system is especially useful in highly repetitive buying tasks such as straight rebuys (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews, Wilson, & Blackhaus, 1977; Parasuraman, 1981). Routine purchases can be handled faster and more economically by the computer than by the purchasing staff (Hutt & Speh, 1992). In the case of a continuing need for standard items, supplies or materials that are bought on a regular basis on pre-established specifications (i.e., straight rebuy), orders can be transmitted directly to the

supplier by entering the order directly into the computer (Hill, Alexander, & Cross, 1975; Kotler & Armstrong, 1994).

Purchasing performance is an important determinant of a firm's competitiveness and is related to the firm's usage of computers in purchasing activities (Noordewier, John, & Nevin, 1990; Sriram & Banerjee, 1994). Purchasing performance can be defined as the minimization of invoice costs, possession costs (i.e., hidden inventory costs), and acquisition costs (i.e., administrative costs), as suggested by Hannaford (1983) and Noordewier et al. (1990). A major indicator of possession cost is inventory turnover and investment in materials inventory (Noordewier et al. 1990; Heinritz & Farrel, 1981). An inventory that does not move costs more than warehousing or interest expenses (Germain, Droge, & Daugherty, 1994). The usage of computers in purchasing allows smaller order sizes and more frequent order shipments, resulting in smaller inventories being held at every point in the channel, thereby improving purchasing performance especially under conditions of high environmental uncertainty (Germain, Droge, & Daugherty, 1994; Noordewier et al., 1990). Acquisition costs arise from the need for originating requisitions, processing purchase orders, and expediting of deliveries. Implementation of computer technology in purchasing significantly reduces such costs by reducing inventory levels and the number of personnel employed in the purchasing

department, and by increasing the speed and accuracy of information transmission (Sriram & Banerjee, 1994).

## Adoption of Technological Innovation

### Adoption Theory

Adoption of an organizational innovation is influenced by the characteristics of individual people (i.e., the organizational leaders), characteristics of the organization, and characteristics of the environment in which the organization operates and out of which it has emerged (Damanpour, 1991; Kimberly & Evaneski, 1981; Rogers, 1983). Technological innovation is considered critical to survival in a turbulent environment (Achrol, 1991), and studies have examined the issue of technological adoption explicitly within an environmental adaptation framework (Kitchell, 1995). Both qualitative and quantitative research methods have been used by the author to examine the adoption issue in relation to corporate culture. Organizational factors have been recognized as the predominant predictors of innovation adoption (Damanpour, 1991; Kimberly & Evaneski, 1981).

Two measures are common for measuring innovativeness: temporal (Rogers, 1983) and cross sectional (Robertson & Myers, 1969). The temporal approach measures innovativeness by the relative time taken to adopt novelties.

Earlier adopters are considered to be more innovative than later ones. The cross-sectional approach measures innovativeness by the number of novelties adopted (Kitchell, 1995). In addition, studies on innovation adoption have used the process approach (Masters, Allenby, Lalonde, & Maltz, 1992) or a factor approach (Lefebvre, Harvey, & Lefebvre, 1991; Masters et al., 1992; O'Callaghan, Kaufmann, & Konsynski, 1992). The process approach is an in-depth study of the sequence of events that leads to the decision to adopt an innovation within a firm. The factor approach, in contrast, examines a cross-section of firms to determine the significant characteristics which influence adoption (Ko, 1993).

**Predictor Variables of Innovation Adoption: Empirical works**

The adoption of innovation has been a subject of study for many years (Rogers, 1983). Innovation is defined as "the adoption of an internally generated or purchased device, system, policy, program, product, or service that is new to the adopting organization" (Damanpour, 1991, p.556). Adoption is the decision to make full use of an innovation, and adoption occurs at the decision stage in the innovation-decision process (Rogers, 1983).

Previous studies in other industries have shown that adoption of innovation is affected by several organizational factors: firm size, product category, company centralization, and vertical coordination between suppliers

and customers. Gatignon and Robertson (1989) developed a model depicting various factors influencing technological adoption. The variables that were significantly found to affect adoption or rejection of an innovation were the structural variables of vertical coordination and company centralization, among others.

Firm size is a significant predictor of innovation adoption (Ettlie, Bridges, O'Keefe, 1984; Kimberly & Evaneski, 1981; Lalonde & Emmelheinz, 1985; Rogers 1983). The availability of discretionary financial resources and a big staff in a large firm supports innovation adoption by large size firms (Rogers 1983). In a study on use of computers in purchasing operations, large size firms were found to be more involved in computerized purchasing than the small size firms (Lalonde & Emmelheinz, 1985; Parasuraman, 1981). In the hospital industry and the food industry, technological innovation was related to firm size (Ettlie, Bridges, & O'Keefe, 1984; Kimberly & Evaneski, 1981). Large firm size also was found to be positively related to the adoption of Quick Response (QR) in the apparel industry (Kincade, 1989; Kincade & Cassill, 1993; Ko, 1993; Sullivan, 1990). In the apparel industry, the firm size varies ranging from very large firms employing 500 employees or more to firms that function by hiring as few as 1-9 employees. Kincade (1989) and Sullivan (1990) found significant positive

relationships between company size and the adoption of QR in the apparel industry in the states of North Carolina and New York, respectively.

Mansfield, Rapport, Schee, and Hamburger (1971) and Ko (1993), in their respective studies on the apparel industry, found that product characteristics were associated with adoption decisions. Apparel products can be divided according to their product lines (Glock & Kunz, 1990). A product line refers to a series of related products that a company offers to its market lines (Glock & Kunz, 1990; Kotler & Armstrong, 1994). Apparel products can be classified into men's, women's, and children's wear according to the Standard Industrial Classification code. Men's and children's wear are less subject to change from year to year and are more suitable for large scale production. Women's wear is more seasonal and fashionable and difficult to predict (Office of Technology Assessment, 1987). Empirical findings have been inconclusive about the effect of product characteristic on adoption decisions. Ko (1993) found product category to be significantly associated with the adoption of QR. The women's wear category was rated higher in QR adoption than was men's or children's/infants' wear. Kincade and Cassill (1993), however, did not find any association between the variables of merchandise category and QR adoption.

These product categories vary in their life cycle as well as in the scale of production, based on the seasonality and fashion position of the item. Gatignon

and Robertson (1989) and Robertson and Gatignon (1986) found demand uncertainty to be significantly associated with innovation adoption among a cross-section of firms. Most apparel products have an inconsistent pattern in demand, causing difficulty in forecasting demand. However, product characteristics such as fashionability and seasonality were not significantly related with QR adoption (Kincade & Cassill, 1993; Ko, 1993).

Organizational centralization is related to the adoption behavior of a firm (Damanpour, 1991; Ettlie, Bridges, & O'Keefe, 1984; Gatignon & Robertson, 1989; Kimberly & Evaneski, 1981; Robertson & Gatignon, 1986; Rogers, 1983). However, there is no consensus among empirical findings about the relationship between centralization and the adoption of innovation (Kimberly & Evaneski, 1981). Centralization refers to the concentration of decision-making authority in the hands of top management versus dispersion of power. Centralized purchasing leads to specialization and control in an organization and gives the company more purchasing power. Large organizations with multiple plant locations prefer centralized buying mechanisms due to reasons of cost efficiency (Fearon, 1989; Hutt & Speh, 1992; Kotler & Armstrong, 1994).

Vertical coordination between suppliers and their customers influences innovation adoption decisions (Ettlie & Reza, 1992; Gatignon & Robertson, 1989; Robertson & Gatignon, 1986). Vertical coordination implies a high degree of

vertical dependence, such as between airframe manufacturers and airlines, and there is a propensity for coordination and interlocking relationship (Palmer, 1983; Schoorman, Bazerman, & Atkin, 1981). Vertical coordination refers to the creation of vertical links between manufacturers and their suppliers. These links can be established through a relational exchange between manufacturers and their suppliers, through formation of strategic alliances and partnerships between manufacturers and their suppliers, or through ownership and integration of the suppliers with manufacturers (Frazier, Spekman, & O'Neal, 1988; Gatignon & Robertson, 1989; Gentry, 1993; Kotler & Armstrong, 1994). A relational exchange occurs when manufacturers develop a long term relationship with their suppliers, trading partners have an ongoing commitment, and the focal point of exchange is not price consideration but rather value added services. A strategic partnership between a purchaser and a supplier has been defined as "a mutual ongoing relationship involving a commitment over an extended time period and a sharing of information along with the risk and rewards of the relationship" (Gentry, 1993; p. 11). Strategic alliances or partnerships between the buyers and sellers can strengthen the smooth flow of information and make new technology available to firms (Gentry, 1993). Interfirm and interindustry connections set the stage for effective innovation strategies. Damanpour (1991) stated that, in the absence of hierarchical levels in

a firm, the flow of communication is facilitated between the channel members making them open to innovation adoption. Vertical coordination provides access to external informational environments.

## Summary of the Review of Literature

Several points of importance have been made in the review of literature that need to be re-emphasized because of their critical relevance to this present research. The typology of purchasing situations, the predictor variables of innovation adoption, and the purchasing performance measures for innovation adoption are each of considerable significance to this research. The models of buyer behavior show that all purchasing transactions are subject to a cyclical process beginning with determining the quantity of the needed item and ending with the evaluation of the products/services and suppliers. Depending upon the type of the purchasing situation (i.e., straight rebuy, modified rebuy, new buy), some stages are more important than others. Specialized buying techniques exist that can be applied to the purchase of goods contingent on whether the goods are ordered on a routine or non routine basis. Electronic ordering, in general, has been considered to be more suitable for making purchases of straight rebuy items that are bought on routine basis. The literature on technological adoption reveals various factors (i.e., individual, environmental, organizational) that exert

influence in the decision making process, when making the decision to adopt or reject an innovation, and stresses organizational variables as the predominant predictors of innovation adoption. The concept of purchasing performance as measured by minimization of possession costs, acquisition costs, and invoice costs is consequential, because it is an important determinant of a firm's competitiveness.

# CHAPTER III

## Statement of Problem

## Research Problem

The purposes of this research were (a) to examine the fabric materials purchasing process of apparel manufacturing firms and (b) to determine the relationship between selected organizational factors of apparel manufacturing firms, firms' usage of computer technology in the fabric materials purchasing process, and firms' purchasing performance.

## Objectives

The specific objectives of the research were:

(1) To determine the types of purchasing situations for fabric materials among the apparel manufacturing firms;

(2) To identify the usage of computer technology in the fabric materials purchasing process among the apparel manufacturing firms;

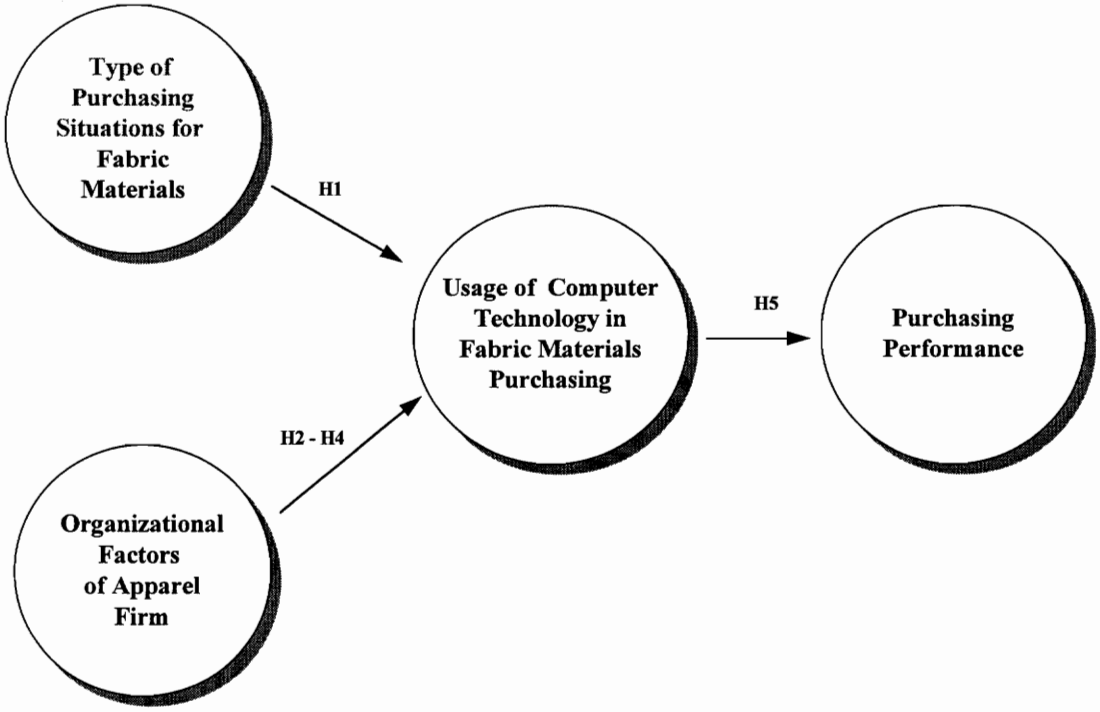
(3) To examine the relationship between type of purchasing situation and usage of computer technology in the fabric materials purchasing process;

(4) To determine the effects of selected organizational variables on firms' usage of computer technology in the fabric materials purchasing process;

(5) To examine the relationship between purchasing performance and usage of computer technology in the fabric materials purchasing process.

## Conceptual Framework

A conceptual framework was developed to provide the foundation for this research. The framework was developed drawing upon the studies of Robinson, Faris, and Wind (1967), Noordewier, John, and Nevin (1990), and Rogers (1983) as well as the empirical work on innovation adoption of several researchers (Damanpour, 1991; Ettlie, Bridges, & O'Keefe, 1984; Gatignon & Robertson, 1989; Kimberly & Evaneski, 1981; Kincade, 1989; Kincade & Cassill, 1993; Ko, 1993; Lalonde & Emmelheinz, 1985). The conceptual framework is illustrated in Figure 2.




CONCEPTUAL FRAMEWORK
Figure 2

Robinson, Faris, and Wind (1967) identified and examined three types of purchasing situations or buyclasses. The buyclass variables presented by them represent a continuum ranging from the purchase of products that the firm has not previously purchased to the purchase of products the firm buys on a routine basis. The purchasing situations are classified according to three primary criteria: the newness of the problem and the extent to which the buyers possess relevant past buying experiences, the amount and type of information required

by the buyers before they can make a final buying decision with confidence, and the number of new alternatives that are considered by the buyers before making the final buying decision. Empirical studies on the usage of computer technology in purchasing have found that the straight rebuy situation is most likely to involve computerization, because items are bought regularly on pre-established specifications (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981). Apparel products demonstrate bi-modal characteristics, comprising of both basic goods and high fashion goods in their product mix (Glock & Kunz, 1990). Trade literature in the apparel industry (DesMarteau, 1995; Gilreath, Reeve, & Whalen Jr., 1995) suggest new buy situations to use computer technology in purchasing for reasons of speed, flexibility, and Quick Response.

Rogers (1983) discussed the predictor variables in innovation adoption, focusing on individual, environmental, and organizational variables affecting adoption. Although individual characteristics of the organizational leaders, environmental characteristics of the period in which the company operates, and organizational characteristics of the company all exercise influence on a firm's decision to adopt an innovation or reject it, the organizational variables of the firm are the predominant predictors of innovation adoption, as shown by empirical research (Damanpour, 1991; Kimberly & Evaneski, 1981).

Organizational variables include product characteristics, centralized purchasing, and vertical coordination. Product category and demand uncertainty, as measures of product characteristics, are related to usage of computer technology as suggested by empirical works (Gatignon et al., 1989; Kincade & Cassill, 1993; Ko, 1993; Robertson et al., 1986). Firms that purchase at a central location for the entire firm are predicted to be related to usage of computer technology (Damanpour, 1991; Gatignon et al., 1989; Kimberly & Evaneski, 1981; Robertson et al., 1986; Rogers, 1983). Similarly, firms that are in partnerships with their suppliers or own the supply chain are predicted to have higher usage of computer technology in their purchasing activities (Damanpour, 1991; Ettlie & Reza, 1992; Gatignon et al., 1989; Robertson et al., 1986).

Purchasing performance is influenced by the usage of new technology (Heinritz & Farrel, 1981). Empirical works (Carter & Ragatz, 1991; Lalonde & Emmelhainz, 1985; Sriram & Banerjee, 1994) have found increased cost effectiveness and low inventory levels with the use of computers in purchasing functions. By allowing small-order flexibility and frequent shipment of orders, firms can hold lower levels of average in-stock inventory, and yet be responsive to consumers (Germain et al., 1994). Purchasing performance is enhanced with increased usage of computer technology in the purchasing process.

The conceptual framework in Figure 2 diagrams the relationships among the organizational factors of firms, types of purchasing situations for fabric materials, and usage of computer technology in the fabric materials purchasing process. Usage of computer technology in fabric materials purchasing is also shown as a predictor of purchasing performance of apparel manufacturing firms. Several hypotheses were developed within the conceptual framework that were related to the third, fourth, and fifth research objectives.

## Conceptual Definitions of major concepts in the Conceptual Framework

**Type of purchasing situation** refers to the three buyclass variables of straight rebuy, modified rebuy, and new buy.

**Organizational factors of apparel firm** refer to the variables of product characteristics, centralized purchasing, and vertical coordination. Product characteristics include product category and demand uncertainty for end-products.

**Usage of computer technology** refers to the adoption of computer technology in purchasing activities of apparel manufacturing firms.

**Purchasing performance** refers to cost effectiveness.

## Research Hypotheses

$H_1$ Type of purchasing situation for fabric materials is related to usage of computer technology in the fabric materials purchasing process.

$H_{2a}$ Apparel product category is associated with the usage of computer technology in the fabric materials purchasing process.

$H_{2b}$ Demand uncertainty for apparel products is associated with the usage of computer technology in the fabric materials purchasing process.

$H_3$ The degree of centralization in purchasing of fabric materials is associated with the usage of computer technology in the fabric materials purchasing process.

$H_4$ The degree of vertical coordination with suppliers is positively associated with the usage of computer technology in fabric materials purchasing process.

$H_5$ Usage of computer technology in fabric materials purchasing process is positively related to purchasing performance.

## Assumptions

The following assumptions were made in this research.

1. The respondents will reveal accurate information regarding questions asked.
2. The independent variables of product characteristics, centralized purchasing, and vertical coordination, included in the study, are the most important variables that affect the usage of computer technology in fabric materials purchasing.
3. Large-size firms have greater financial resources available to invest in new technology.

# CHAPTER IV

## Research Method

The general purpose of this research was to examine the fabric materials purchasing process of apparel manufacturing firms and to determine the relationship among selected organizational factors of apparel manufacturing firms, firms' usage of computer technology in the fabric materials purchasing process, and firms' purchasing performance. The procedures used for achieving the objectives and for testing the research hypotheses are discussed in the following sections: (a) research design, (b) sample selection, (c) instrument, (d) data collection, (e) data analysis, and (f) limitations of the study.

### Research Design

This research followed the analytical survey method, and data were collected using mail questionnaires. The survey method is used to obtain data through observation and implies the assumption that a given phenomenon will follow a common pattern and can be observed again in the future, if conditions under which it exists are the same (Leedy, 1993). A large and dispersed sample can be obtained by using mail questionnaires, which precludes the use of personal interviews. The comprehensiveness of the questionnaire precludes the

use of telephone interviews. The case study method was not considered since this method limits the generalizability of the research results to a larger population (Kerlinger, 1993).

This study used the factor approach as opposed to the process approach to examine the usage of computer technology in the fabric materials purchasing process for apparel manufacturing firms. The factor approach examines a cross-section of firms to determine the significant characteristics which influence adoption (Lefebvre, Harvey, & Lefebvre, 1991; Masters et al., 1992; O'Callaghan, Kaufmann, & Konsynski, 1992). The process approach, in contrast, is an in-depth study of the sequence of events that leads to the decision to adopt an innovation within a firm (Masters, Allenby, Lalonde, & Maltz, 1992).

## Sample Selection

The population for this study consisted of large U.S. apparel manufacturers. The Top 100 Sewn Products Companies for the year 1995, as published in the Apparel Industry Magazine (AIM), was used for the sample (Baird, 1995). This list was supplemented by Dun's Business Rankings (1995). The two lists were categorized by each firm's total revenue and were composed of both public and private apparel companies. More than 200 sewn products companies were surveyed by AIM to compile the Top 100 Sewn Products

Companies. Additional information about the top 100 companies was obtained from annual reports, 10-K's, published reports, and other industry sources (Baird, 1995).

The selection of a sample, consisting solely of large size firms, was based on the assumption that large firms have more financial resources to invest in computer technology for purchasing, such as EDI or Electronic Purchase Order Interchange (EPOI). Prior research has shown that large firms are the first to adopt new innovations (Ettlie, Bridges, & O'Keefe, 1984; Kimberly & Evaneski, 1981; Kincade, 1989; Kincade & Cassill, 1993; Ko, 1993; Lalonde & Emmelheinz, 1985; Rogers 1983). Also, the presence of a purchasing department and purchasing officer was more probable in large size firms than in small or medium size apparel firms. The selected variables of centralized purchasing and vertical coordination were more applicable to large size companies with multiple plants or divisions versus smaller apparel companies which have a single unit or plant and operate locally. All questions on the questionnaire were addressed to the purchasing managers. The approval of the Institutional Review Board for Research was obtained for involving human subjects in the research (see Appendix A).

## Instrument

A mail questionnaire was used to collect the data. The questionnaire consisted of five distinct sections and addressed the following aspects: purchasing policies of the firm, supplier relationships, and company demographics (see Appendix C). The items in the questionnaire were selected from the literature with minor modifications for the apparel industry (Anderson, Chu, & Weitz, 1987; Frazier, Spekman, & O'Neal, 1988; Gatignon & Robertson, 1989; Kincade, 1989; Ko, 1993; Lalonde & Emmelhainz, 1985; Noordewier, John, & Nevin, 1990; Robertson & Gatignon, 1986).

The questionnaire was pilot tested with the purchasing personnel of two large apparel manufacturing firms. The questionnaire also was distributed to selected secretaries, who were employed by individual departments of Virginia Polytechnic Institute and State University and involved with purchasing activities. The participants were asked to examine the instrument for clarity and adequacy of terminology. Through the pilot test, content validity and face accuracy and reliability of the questions were evaluated. No changes were indicated by the participants.

To further evaluate the reliability and to check for consistency of the questions, principal components factor analysis was performed for multi-dimensional constructs which were measured with multiple questions. The

resulting factors were evaluated against the constructs before performing further data analysis. Items were determined to load on a factor if they loaded higher than .64 on one factor (Nunnally, 1978). Additional reliability tests such as coefficient alpha were conducted to evaluate the reliability of the variables.

The scales employed in this study are based on perceptual measures. This approach follows other behavioral science studies that have used perceptual measures to adequately and accurately reflect the degree of environmental uncertainty to which one responds (Spekman & Stern, 1979; Weick, 1969), the degree of structure experienced by a particular individual (Duncan, 1972), and the influence patterns within a group (March, 1955). The reliability of the present study was enhanced by using scales that have been used in previous studies for measuring similar variables of uncertainty and structure experienced by individuals/companies.

**Purchasing Policies**

Section I to Section III of the instrument deals with purchasing policies and was designed to provide data for the examination of the following relationships: relationship between the types of purchasing situations and the usage of computer technology in the fabric materials purchasing process, and

relationship between the organizational variable of centralized purchasing and the usage of computer technology in the fabric materials purchasing process.

**Purchasing Situation.** The purchasing situation, as represented by the buyclass variables of straight rebuy, modified rebuy, and new-buy, was measured by information requirements, newness of task, and consideration of alternatives. The questions were developed from the review of literature (Anderson, Chu, & Weitz, 1987; Robinson et al., 1967). The respondents were asked to rate the information requirements, newness of task, and consideration of alternatives on a scale of 0 (never) to 4 (always). Questions 1-3 were specifically designed to measure the newness of the task, questions 4-5 measured the information requirements, and questions 6-7 measured the consideration of alternatives. Questions 1, 2, and 4 were reversely coded. A factor analysis was performed to test the reliability of these groupings. Adjustments were made and summation scores were used for each factor.

**Usage of Computer Technology.** The usage of computer technology was measured by the firms' usage of computers to conduct the following 12 purchasing activities: determine the quantity of the needed item, describe the characteristics of the needed item, search for supplier sources, request for price quotations, prepare purchase orders, transmit purchase orders, expedite, monitor purchase order status, send invoices, record vendor history, evaluate

buyer performance, and evaluate vendor performance. The questions relating to this second objective were taken from Lalonde and Emmelhainz (1985), Robinson et al., (1967), and Zenz (1981) and were included in Section II. The respondents were asked to report their usage level of computers by indicating on the following scale: 0 (never) to 4 (always), with the summation score ranging from 0 to 48. A coefficient alpha test was performed to evaluate the reliability of the usage of computer technology measure.

**Centralized Purchasing.** The organizational variable of centralized purchasing was measured by the location in which the purchasing activities of the firm were performed. Section III of the questionnaire dealt with this variable of centralized purchasing, and the two questions were developed from Fearon (1988). The respondents were asked choose on a scale of 0 (never) to 4 (always) whether purchasing activities were performed at individual plant locations or at one central location for the entire firm. By subtracting the score obtained on question 2 from the score obtained on question 1 (i.e., $Q_1$-$Q_2$) in Section III of the questionnaire, the centralized purchasing variable was measured, and scores ranged from -4 (highly centralized) to +4 (decentralized).

## Supplier Relations and Company Demographics

Section IV and Section V of the instrument dealt with supplier relations and company demographics and were designed to provide data for the examination of the following relationships: relationship between the organizational variable of product characteristics and the usage of computer technology in the fabric materials purchasing process; relationship between the organizational variable of vertical coordination and the usage of computer technology in the fabric materials purchasing process; and relationship between the usage of computer technology in the fabric materials purchasing process and purchasing performance.

**Product Characteristics.** The organizational variable of product characteristics was measured by product category and demand uncertainty experienced for end-products produced by the apparel manufacturing firm. Product category was divided into three groups: men's, women's, and children's/infants' wear as itemized in the SIC codes. A fourth section, others, was added to cover all possible answers such as sportswear and unisex wear. The questions relating to this variable were taken from the literature (Kincade, 1989; Ko, 1993; Gatignon et al., 1989; Tullous & Munson, 1993) and were included in Section V of the instrument. Respondents were asked to choose a single best answer from a forced-choice question on category of product category. Demand

uncertainty was measured by difficulty faced in predicting demand, by the seasonality, and by fashion change of end-products (Section IV: question 10, 11, and 12). Respondents were asked to choose the appropriate number on a continuum ranging from 0 (strongly disagree) to 4 (strongly agree). A summation of the scores provided the measurement for demand uncertainty variable, and summation scores ranged from 0 to 12. A factor analysis was performed to test the reliability of grouping together questions, that measured demand uncertainty.

**Vertical Coordination.** Vertical coordination was measured in terms of the frequency of communication, nature of information exchanged, time horizon of relationship, and ownership of the supply chain. Vertical links are created between manufacturers and their suppliers through alliances and partnerships or through the ownership and integration of the suppliers with manufacturers. The questions relating to this variable were taken from the review of literature (Frazier, Spekman, & O'Neal, 1988; Robertson & Gatignon, 1986, 1989). After performing factor analysis on questions 1 to 3 in Section IV, responses were summed to create an overall measure for the variable of vertical coordination, and summation scores ranged from 0 to 12. Responses to question 4 in Section IV on ownership of the supply chain, as an addtional measure of vertical coordination, was tested separately.

**Purchasing Performance**. Purchasing performance of the firm was measured in terms of cost effectiveness (i.e., possession cost: [frequent shipment of order, size of shipment, and inventory turnover]; acquisition cost: [defect free orders, orders meeting specifications, and orders delivered on time]; and invoice cost: [paper-work free orders]). The questions relating to this variable were taken from the literature (Heinritz & Farrel, 1981; Noordewier, John, & Nevin, 1990; Sriram & Banerjee, 1994). Questions 7 and 8 in Section IV, and question 1 in Section V measured possession cost. The respondents were asked to indicate on a scale of 0 (never) to 4 (always) whether they received frequent shipment of orders and had small size of shipment (Section IV, question 7 and 8 respectively). The respondents were asked to quote an average figure for their annual inventory turnover for the fabric materials being purchased (Section V, question 1). A high turnover figure signifies lower in-stock average inventory level.

Acquisition cost was measured by questions 2a, 2b, and 2c in Section V. Respondents were asked to fill in a percentage figure for each question, and percentages ranged between 0% to 100%. The percentages were averaged together to form the overall acquisition cost measure. A factor analysis was performed to test the reliability of grouping questions for acquisition cost. Invoice costs were measured by question 2d in Section V.

## Data Collection

In January 1996, questionnaires were mailed to the purchasing managers of 118 apparel manufacturing firms. The mailing process followed the procedure used by Kincade (1989) and Ko (1993). The initial mailing packet included a cover letter (see Appendix B) mentioning the purpose of the research and self addressed stamped envelopes for returning the questionnaires. A time period of four weeks was allotted for the return of the questionnaires. An executive summary was offered to the apparel manufacturers as an incentive for returning the questionnaires. To maintain the confidentiality of the apparel manufacturers and to monitor the returned questionnaires, numbers were assigned to each of the manufacturers. The return envelopes were numbered before the actual mailing. Post cards were mailed a week after the initial mailing to serve as a thank you/reminder. The questionnaire was separated from the return envelope before data analysis. Phone calls were made at random to non-respondents to investigate the reasons for nonresponse.

## Data Analysis

The ordinary least squares regression analysis was used to examine the relationship between types of purchasing situation and usage of computer technology in fabric materials purchasing process ($H_1$), and relationship between centralized purchasing and usage of computer technology in fabric materials purchasing process ($H_3$). For Hypothesis 2 ($H_{2a}$ and $H_{2b}$), two separate tests were performed on the two aspects of product characteristics. Rank based One-way Analysis of Variance, also called Kruskal-Wallis test, was conducted for testing the relationship between product category and usage of computer technology in fabric materials purchasing process ($H_{2a}$). Regression analysis was conducted to test the relationship between demand uncertainty and usage of computer technology in fabric materials purchasing process ($H_{2b}$). A one-sided (right tailed) Spearman's Correlation test was performed to test the relationship between vertical coordination and usage of computer technology in fabric materials purchasing process ($H_4$). Analysis of Variance was used to examine the relationship between usage of computer technology in fabric materials purchasing process and purchasing performance ($H_5$). Separate ANOVA tests were administered for each question measuring possession cost. Acquisition cost and invoice cost were also tested using ANOVA.

## Limitations

1. Selection of respondents was limited to large apparel manufacturing companies. This sample limited the generalizability of results to large-size manufacturing companies.
2. Other variables that might be of importance in the usage of computer technology may have been excluded.

# CHAPTER V

## Results and Discussion

This study focused on the fabric materials purchasing process of apparel manufacturing firms and examined (a) the selected independent variables that were expected to have relationships with usage of computer technology and (b) the relationship between usage of computer technology and purchasing performance.

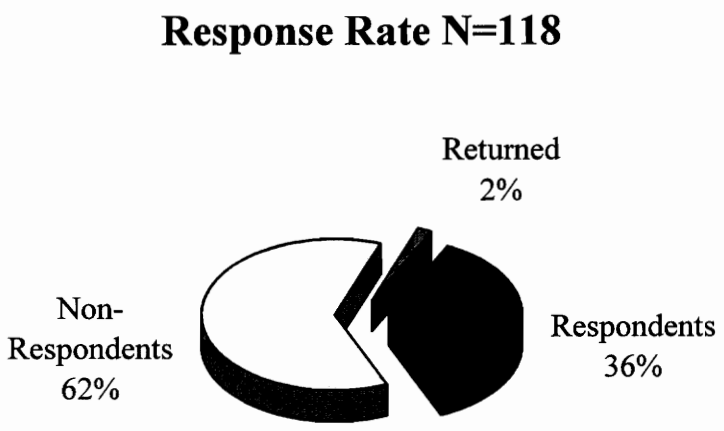
The results of this study are presented in the following sections: (a) response rate of the survey, (b) demographic profile of the respondents, (c) purchasing situations for fabric materials, (d) usage of computer technology, (e) relationship between types of purchasing situations and usage of computer technology, (f) relationship between selected organizational variables and usage of computer technology, and (g) relationship between usage of computer technology and purchasing performance.

### Response Rate of the Survey

The sample for this study consisted of 118 apparel manufacturing firms. Questionnaires were mailed in the beginning of January, and, by the end of the month, 45 questionnaires were returned with a response rate of 38%. The use of follow-up post cards was effective in increasing the response rate from 19% to

38%. Two questionnaires were returned unanswered because: (a) the firm was unwilling to participate in the survey and (b) the firm did not conduct fabric materials purchasing activities, respectively. No wrong addresses or closure of firms were reported. The response rate of the survey is summarized in Figure 3, which indicates the proportion of respondents and non-respondents, including returned/unanswered questionnaires.

Upon examination, the general characteristics of the non-respondents (i.e., size, sales volume) were found to be similar to those of the respondents. This enhanced the reliability of the sample. Any bias in the results due to sampling error was thus reduced.

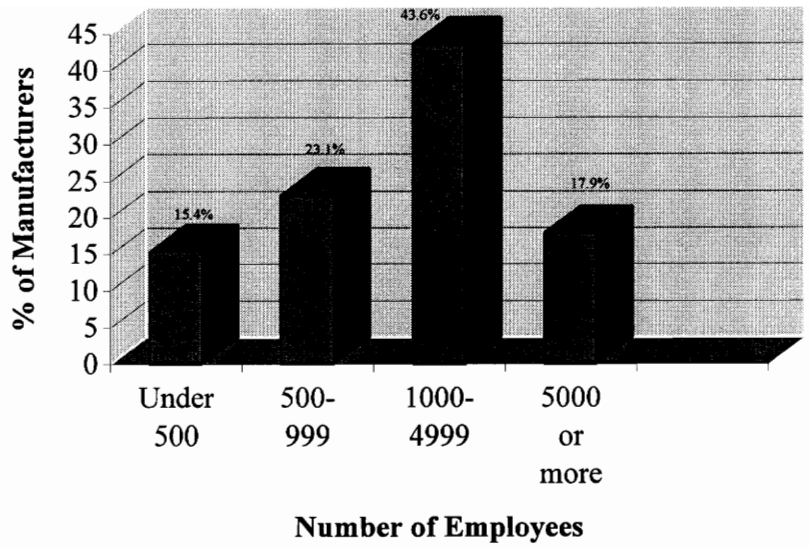



RETURN RATE FOR THE SURVEY
Figure 3

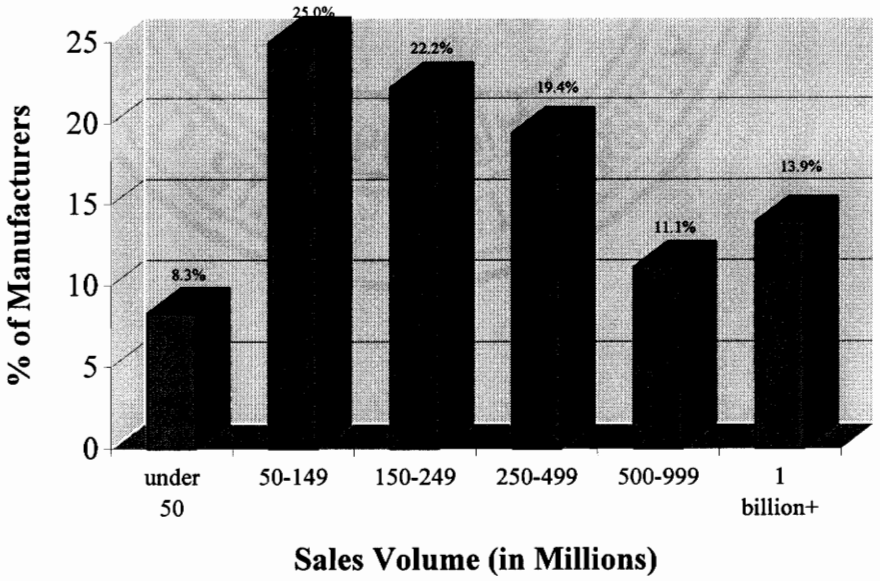
## Demographic Profile of the Respondents

Responses were tabulated and graphed by product category and firm size (i.e., number of employees, annual sales volume). Frequencies and percentages were used to describe the sample, which was composed of large-size firms only. A chi square was conducted on number of employees and sales volume ($\chi^2$ [15, N=35] = 35.996, $p$ = 0.002), and a significant relationship was found. A similar relationship was found by Kincade (1989) and Ko (1993) in studies of apparel manufacturers, which supports the reliability of the present sample.

The size of these companies varied in terms of number of employees and sales volume. Figure 4 and Figure 5 illustrate the size breakdown of companies based on number of employees and sales volume. Most of the companies that responded had employees between the 1000 to 4999 range (43.6%). All the remaining categories for number of employees (under 500; 500-999; 5000+) had a relatively equal distribution of manufacturers in the sample (15.4%; 23.1%; 17.9% respectively). In terms of sales volume, $50-149M (25%) had the highest representation in the sample, followed by $150-249M (22.2%), and $250-499M (19.4%). Table 5 indicates the responses grouped by firm size and product category.




SIZE BREAKDOWN OF COMPANIES BASED ON NUMBER OF EMPLOYEES
Figure 4



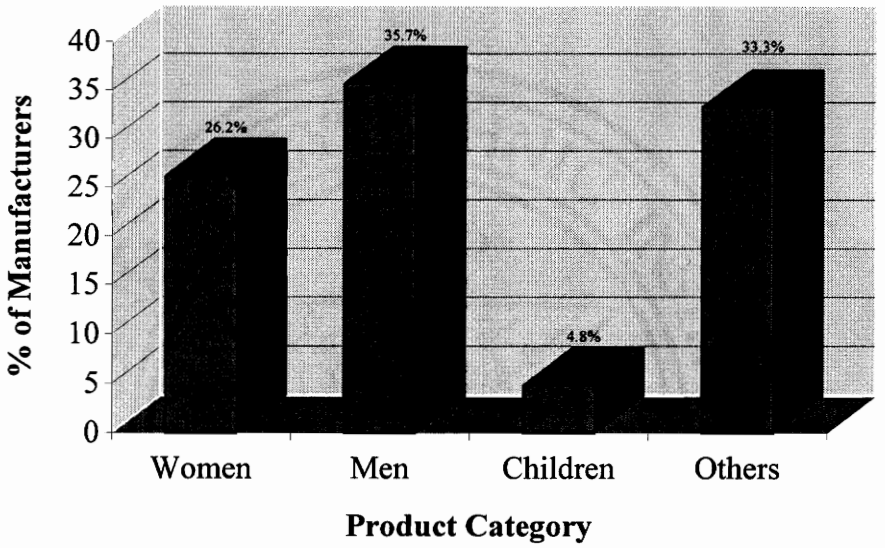

SIZE BREAKDOWN OF COMPANIES BASED ON SALES VOLUME
Figure 5

**Table 5**
**Percentage and Frequency Distribution of Respondents by Product Category and Firm Size**

| *Firm Size* | *Product Category* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *No. of Employees* | *Women* | | *Men* | | *Children* | | *Others* | |
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| 1-500 | 2 | 5.13 | 1 | 2.56 | 0 | 0 | 3 | 7.69 |
| 500-999 | 4 | 10.26 | 3 | 7.69 | 0 | 0 | 2 | 5.13 |
| 1000-4999 | 3 | 7.69 | 5 | 12.8 | 2 | 5.13 | 7 | 17.65 |
| 5000+ | 0 | 0 | 5 | 12.8 | 0 | 0 | 2 | 5.13 |
| Total | 9 | 23.08 | 14 | 35.9 | 2 | 5.13 | 14 | 35.90 |
| | | | | | | | | |
| *Annual Sales* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| under 50M | 1 | 2.78 | 1 | 2.78 | 0 | 0 | 1 | 2.78 |
| 50-149M | 2 | 5.56 | 1 | 2.78 | 2 | 5.56 | 4 | 11.11 |
| 150-249M | 2 | 5.56 | 3 | 8.33 | 0 | 0 | 3 | 8.33 |
| 250-499M | 4 | 11.11 | 1 | 2.78 | 0 | 0 | 2 | 5.56 |
| 500-999M | 0 | 0 | 2 | 5.56 | 0 | 0 | 2 | 5.56 |
| 1B+ | 0 | 0 | 4 | 11.1 | 0 | 0 | 1 | 7.78 |
| Total | 9 | 25.0 | 12 | 33.3 | 2 | 5.56 | 13 | 36.11 |

In terms of product category, men's and women's wear were represented almost equally in the sample (35.7%, 26.2% respectively). The category for children's wear was small (4.8%), and the others category was large (33.3%). The others category included intimate apparel together with swimwear, sportswear, and uniforms. These categories are included in a gender related category by SIC classification methods, but respondents indicated themselves as other. This latter finding is consistent with the general profile of the U.S. manufacturers (Dickerson, 1991). The prominence of niche categories is consistent with

previous research (Kincade & Cassil, 1993). Figure 6 illustrates the respondents by the product category.




RESPONDENTS BY PRODUCT CATEGORY
Figure 6

## Purchasing Situations for Fabric Materials

The first objective of this study was to determine the types of fabric materials purchasing situations for the apparel manufacturers. The purchasing situation construct was measured along three dimensions (i.e., newness of task, information requirements, consideration of alternatives). The questions were rated on a scale of 0 to 4. A high score on each question indicated the purchasing situation was in the new buy category, and a low score indicated the purchasing situation to be a straight rebuy situation. A middle score indicated a modified rebuy situation. Table 6 illustrates the question-wise breakdown of the three dimensions of purchasing situations: newness of task, information requirements, and consideration of alternatives. The first three of the seven questions in Table 6 were designed to measure the newness of the purchasing task. The middle two questions were designed to measure the need to gather new information. The last two questions were designed to measure consideration of alternative suppliers and products/fabrics.

**Table 6**
**Question-wise Breakdown for Newness of Task, Information Requirements, and Consideration of Alternatives Dimensions**
Percentage of Respondents Reporting

| ***Questions on Purchasing Situation Dimensions*** | | **Never** | | | | **Always** |
|---|---|---|---|---|---|---|
| | ***(n)*** | **0** | **1** | **2** | **3** | **4** |
| A reorder of previously purchased fabrics | 43 | 9.3 | 62.8 | 25.6 | 2.3 | 0 |
| Orders with same fabric requirements | 43 | 23.3 | 44.2 | 18.6 | 11.6 | 2.3 |
| Orders with different fabric requirements | 40 | 2.5 | 42.5 | 42.5 | 10.0 | 2.5 |
| Complete knowledge of fabric characteristics | 43 | 44.2 | 41.9 | 11.6 | 2.3 | 0 |
| New information requirements | 40 | 0 | 35.0 | 45.0 | 12.5 | 7.5 |
| Consideration of alternative suppliers | 43 | 0 | 46.5 | 44.2 | 9.3 | 0 |
| Consideration of alternative fabrics | 43 | 0 | 30.2 | 41.9 | 20.9 | 7.0 |

A factor analysis was performed to test the dimensionality of the purchasing situation questions relative to the dimensions of: newness of task, information requirements, and consideration of alternatives. Two factors were identified (see Table 7). Factor 1 captured two elements: newness of the task and information requirements. Items representing the third dimension of buyclass (i.e., consideration of alternatives) loaded on Factor 2. Two questions were dropped, because they did not meet the criteria for loading.

Coefficient alpha for Factor 1, newness and information requirements, is .62, an adequate level of reliability for basic research (Nunnally, 1978). The coefficient alpha for Factor 2, consideration of alternatives measure is .41, which indicates only a modest reliability for the measure (see Table 7); however, the factor is consistent in concept with the predicted dimension. Both factors were retained to represent purchasing situation in further analysis.

**Table 7**
**Factor Analysis of Purchasing Situation Variable**

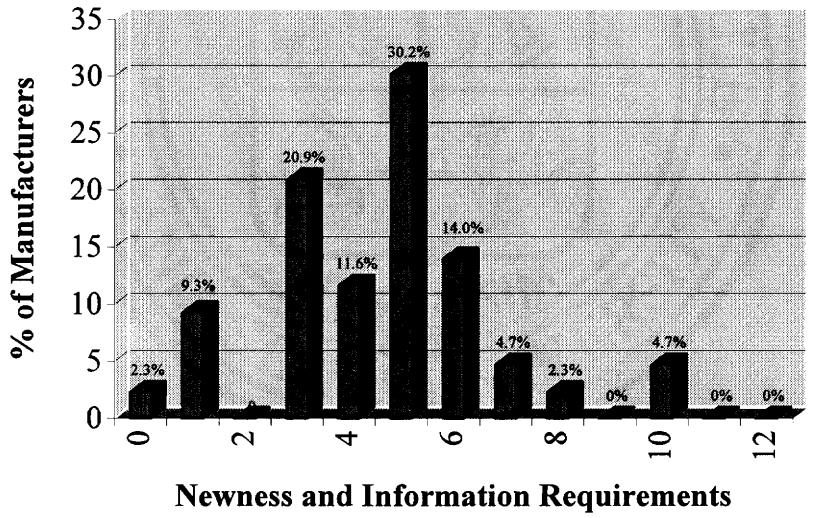
| *Factor Analysis* | *Loading* | *Eigenvalue* | *Coefficient alpha* |
|---|---|---|---|
| ***Newness and Information Requirements*** | ***Factor 1*** | 1.13 | .62 |
| Orders with same fabric requirements | 0.67 | | |
| Orders with different fabric requirements | 0.64 | | |
| New information requirements | 0.71 | | |
| ***Consideration of Alternatives*** | ***Factor 2*** | 1.93 | .41 |
| Consideration of alternative suppliers | 0.74 | | |
| Consideration of alternative fabrics | 0.71 | | |

Given the multi-dimensionality of the three buyclass characteristics, two measures were developed: (a) measure of newness and information requirements and (b) measure of consideration of alternatives (see Table 8). These findings are

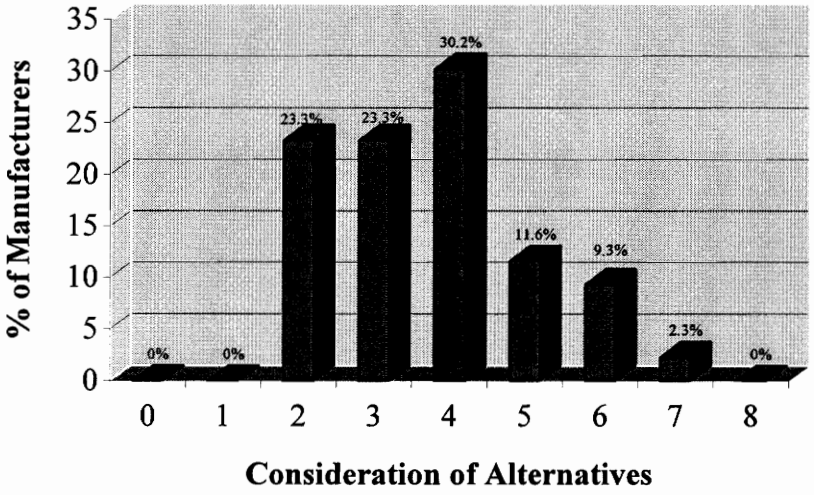
contrary to the prediction that the buyclass model has three dimensions (Robinson et al., 1967), but are consistent with the findings of Anderson, Chu, and Weitz (1987), who also found the same two factors to predominate.The frequency distribution for types of purchasing situation is shown in Table 8. As indicated in Table 8, 84.4% of the apparel manufacturers had low to moderate scores on the newness and information requirements dimension, indicating their purchasing situations were mainly straight rebuy and moderate rebuy situation. The consideration of alternatives dimension also had low to moderate scores, and 81.3% of the manufacturers were included in the straight rebuy and moderate rebuy situation. These low scores indicate that the respondents chiefly represented the straight rebuy and modified rebuy purchasing situation (see Figures 7 and 8).

**Table 8**
**Types of Purchasing Situations for Fabric Materials for Apparel Manufacturers**
Percentage of Respondents Reporting

| *Purchasing Situations* | **Never** | | | | **Always** |
|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** |
| newness and information requirements | 8.6 | 40.5 | 35.3 | 11.3 | 4.1 |
| consideration of alternatives | 0 | 38.3 | 43.0 | 15.1 | 3.5 |




PURCHASING SITUATION FOR APPAREL MANUFACTURERS
Figure 7




PURCHASING SITUATION FOR APPAREL MANUFACTURERS
Figure 8

## Usage of Computer Technology in Purchasing Process

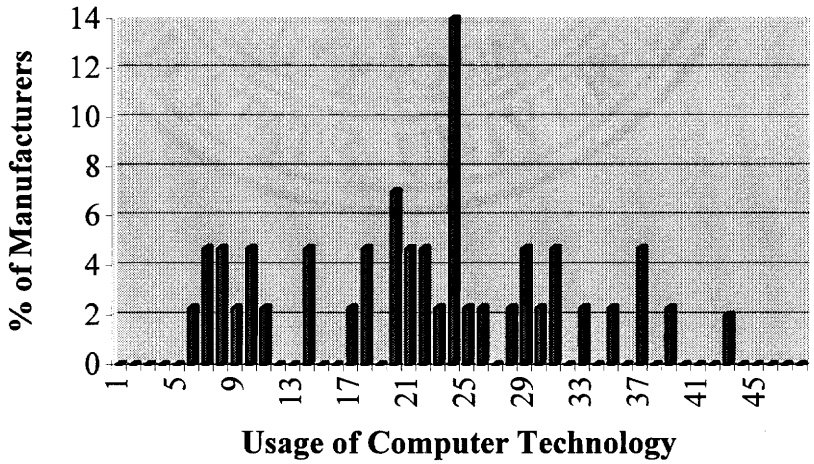
The second objective of the research was to identify the usage of computers in the firms' purchasing process. A list of 12 purchasing activities was developed from the literature (Lalonde & Emmelhainz, 1985; Robinson et al., 1967; Zenz, 1981) to measure the usage of computer technology in fabric materials purchasing by apparel manufacturers. The frequency distribution, shown in Table 9, identifies how the usage of computer technology in purchasing differs across the types of purchasing activities being performed.

**Table 9**
**Usage of Computer Technology in Purchasing Activities**
Percentage of Respondents Reporting

| *Purchasing Activities* | | Never | | | | Always |
|---|---|---|---|---|---|---|
| | *(n)* | 0 | 1 | 2 | 3 | 4 |
| Determine quantity | 43 | 7.0 | 7.0 | 11.6 | 30.2 | 44.2 |
| Describe fabric | 42 | 23.8 | 11.9 | 14.3 | 23.8 | 26.2 |
| Search for supplier sources | 43 | 51.2 | 25.6 | 16.3 | 4.7 | 2.3 |
| Request for price quotations | 43 | 58.1 | 14.0 | 18.6 | 7.0 | 2.3 |
| Prepare purchase order | 42 | 9.5 | 4.8 | 9.5 | 21.4 | 54.8 |
| Transmit purchase order | 43 | 53.5 | 14.0 | 2.3 | 11.6 | 18.6 |
| Expedite | 43 | 37.2 | 16.3 | 9.3 | 18.6 | 18.6 |
| Monitor purchase order status | 43 | 7.0 | 9.3 | 16.3 | 27.9 | 39.5 |
| Send invoices | 38 | 42.1 | 0.0 | 15.8 | 18.4 | 23.7 |
| Evaluate buyer performance | 43 | 46.5 | 9.3 | 16.3 | 9.3 | 18.6 |
| Evaluate vendor performance | 43 | 41.9 | 9.3 | 14.0 | 11.6 | 23.3 |
| Record vendor history | 43 | 25.6 | 4.7 | 20.9 | 11.6 | 37.2 |

The most common purchasing activities, for which computer technology was used, were: determining the quantity of needed fabric, preparing purchase order, monitoring purchase order status, and recording vendor history. Those purchasing activities, for which little or no computer technology was used, were: searching for supplier sources, requesting price quotations, transmitting and expediting purchase orders, sending invoices, and evaluating buyer and vendor performances (see Table 9). A finding of this study was that either computer technology was used or not used for specific activities by apparel manufacturers. Few manufacturers reported moderate usage of computer technology on a specific activity.

When seen at the global level, however, the overall usage of computer technology for purchasing process is moderate for apparel manufacturing firms in the sample (see Figure 9). This can be explained because the respondents reported either high or low usage of computer technology for specific purchasing activities, and therefore the overall picture of usage of computer technology emerges as moderate. The variable usage of computer technology was formed by a summation of the scores on all of the specific purchasing activities. The coefficient alpha of .82 was obtained for the usage of computer technology variable, which is a high level of reliability for the measure (Nunnally, 1978). This summation variable was used to represent usage of computer technology in further analysis.




USAGE OF COMPUTER TECHNOLOGY IN PURCHASING PROCESS
Figure 9

**Breadth of Computerization by Purchasing Activity**

Among the manufacturers who were currently on-line, the manufacturers were using computers mainly within the purchasing department (see Table 10). Very few manufacturers were connected via computers to vendors. The main activities, for which the respondents were linked with their vendors via computer network, were determine quantity, describe fabric, and monitor purchase order status.

**Table 10**
**Breadth of Computerization by Purchasing Activity**
Percentage of Respondents Reporting

| *Purchasing Activity* | *Not On-Line* | *Currently On-line* | *Breadth of On-line System* | | |
|---|---|---|---|---|---|
| | | | *Within Purchasing* | *Firm-wide* | *With Vendor* |
| Determine quantity | 9.5 | 90.5 | 76.2 | 38.1 | 14.3 |
| Describe fabric | 22.0 | 78.0 | 51.2 | 46.3 | 19.5 |
| Search for supplier sources | 68.3 | 31.7 | 29.3 | 2.4 | 4.9 |
| Request for price quotations | 57.5 | 42.5 | 35.0 | 5.0 | 7.5 |
| Prepare purchase order | 12.2 | 87.8 | 78.0 | 14.6 | 4.9 |
| Transmit purchase order | 56.1 | 43.9 | 34.1 | 7.3 | 4.9 |
| Expedite | 41.5 | 58.5 | 46.3 | 9.8 | 9.8 |
| Monitor Purchase Order Status | 14.3 | 85.7 | 76.2 | 16.7 | 14.3 |
| Send Invoices | 62.5 | 37.5 | 17.5 | 20.0 | 5.0 |
| Evaluate buyer performance | 61.9 | 38.1 | 33.3 | 4.8 | 2.4 |
| Evaluate vendor performance | 45.2 | 54.8 | 50.0 | 7.1 | 2.4 |
| Record vendor history | 21.4 | 78.6 | 69.0 | 26.2 | 2.4 |

The most commonly used technologies for communicating purchasing activities were phone and telex/fax (see Table 11). Computer to computer linkage between manufacturers and their vendors was negligible. Table 11 summarizes the current methods of communicating purchasing actions.

Purchasing activities of invoice payment and purchase orders were done primarily through mail. Expediting, status reporting, pricing, and determining product availability and delivery dates were communicated predominantly through the use of phone and telex/fax. In addition, respondents reported very low rates for usage of ANSI (28.0%), TALC, or FASLINC standards (32.2%), as shown in Table 12. These findings suggest the need for developing and using standard document formats to enable transmission of inter-company documents by business organizations.

**Table 11**
**Current Methods of Communicating Purchasing Actions**
Percentage of Respondents Reporting

| ***Purchasing actions*** | ***Phone (voice)*** | ***Telex/ Fax*** | ***Mail*** | ***Supplier generated computer print-outs*** | ***Terminal to computer*** | ***Computer to computer*** |
|---|---|---|---|---|---|---|
| Product Availibility /Delivery Dates | 90.5 | 90.5 | 31.0 | 50.0 | 9.5 | 7.1 |
| Pricing Information | 87.8 | 80.5 | 43.9 | 17.1 | 2.4 | 2.4 |
| Purchase Orders | 66.7 | 83.3 | 69.0 | 16.7 | 11.9 | 7.1 |
| Expediting | 85.7 | 85.7 | 26.2 | 21.4 | 9.5 | 9.5 |
| Status Reporting | 81.0 | 78.6 | 19.0 | 40.0 | 16.7 | 9.5 |
| Invoice Payment | 12.5 | 25.0 | 92.5 | 12.5 | 5.0 | 5.0 |

**Table 12**
**Percentage and Frequency Distribution for ANSI and TALC/FASLINC Standards**

| *Standards* | Never | | | | | | | | | Always |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | 1 | | 2 | | 3 | | 4 | |
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| ANSI | 13 | 52.0 | 1 | 4.0 | 4 | 16.0 | 6 | 24.0 | 1 | 4.0 |
| TALC/FASLINC | 13 | 46.4 | 1 | 3.6 | 5 | 17.9 | 5 | 17.9 | 4 | 14.3 |

## Relationship between Purchasing Situations and Usage of Computer Technology

The third objective of this study was to determine the relationship between types of purchasing situation and the usage of computer technology in the fabric materials purchasing processes. Purchasing situation was measured along the dimensions of (a) newness and information requirements and (b) consideration of alternatives. Based on previous studies (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981), it was expected that straight rebuy situations would be related to higher usage of computer technology. Based on the cited trade literature in the apparel industry (DesMarteau, 1995; Gilreath et al., 1995) it was expected that new buy situations would also be related to usage of computer technology in purchasing activities.

**Hypothesis 1**

*$H_1$: Type of purchasing situation for fabric materials is related to the usage of computer technology in the fabric materials purchasing process.*

Ordinary least squares regression analysis was used to test $H_1$. Two regression models with linear and quadratic terms (i.e., newness and information requirements [NEW+INFO] and consideration of alternatives [ALT]) were specified to examine the relationship between purchasing situation and usage of computer technology (USAGE). To measure the relationship between newness and information requirements and usage of computer technology, the following regression model was specified:

$$USAGE_i = \beta_0 + \beta_1*(NEW+INFO)_i + \beta_2*(NEW+INFO)_i^2 + \in_i$$

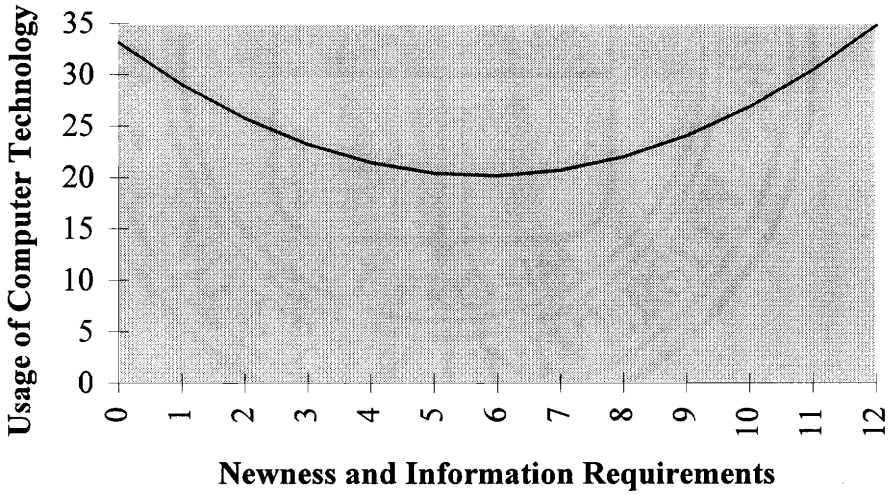
The fitted model obtained was as follows:

$$USAGE = 33.078 - 4.454*(NEW+INFO) + 0.383*(NEW+INFO)^2$$

The *p*-values based on the *t*-statistics for the linear term ($p = 0.041$) and quadratic term ($p = 0.071$) support that newness and information requirements is related to usage of computer technology (see Table 13). The fitted quadratic model indicates a significant bi-polar relationship between newness and information requirements and usage of computer technology see Figure 10).

**Table 13**
**Results of Regression: Usage of Computer Technology on Newness and Information Requirements**

| *Independent Variable* | *df* | *Regression Coefficient* | *t-value* | *p-value* |
|---|---|---|---|---|
| Intercept | 1 | 33.078 | 6.338 | 0.0001 |
| NEW+INFO | 1 | -4.454 | -2.102 | 0.0419 |
| NEW+INFO $^2$ | 1 | 0.383 | 1.853 | 0.0712 |




RELATIONSHIP BETWEEN USAGE OF COMPUTER TECHNOLOGY AND NEWNESS AND INFORMATION REQUIREMENTS
Figure 10

Additionally, the following regression model was specified to test the relationship between consideration of alternatives (ALT) and usage of computer technology (USAGE):

$$USAGE_i = \beta_0 + \beta_1*(ALT)_i + \beta_2*(ALT)_i^2 + \in_i$$

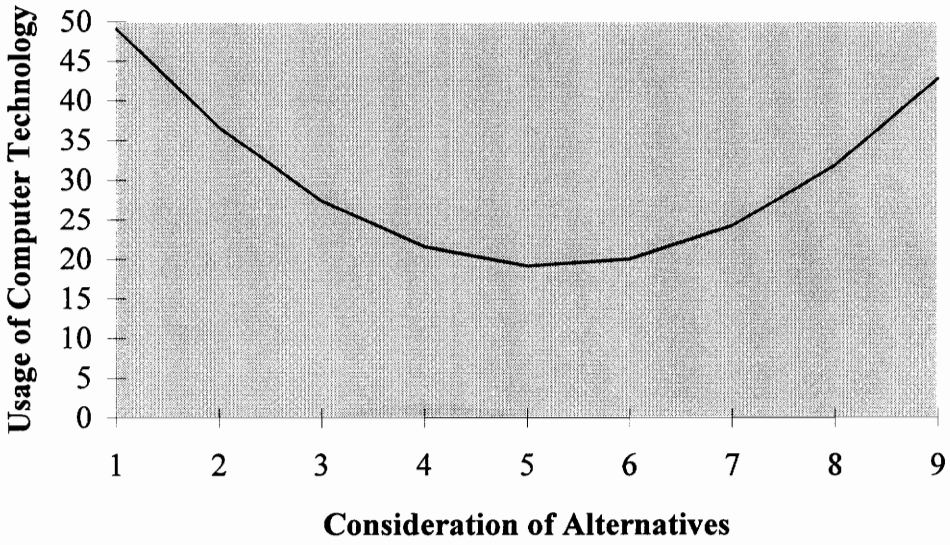
The fitted model obtained was as follows:

$$USAGE = 49.079 - 14.198*(ALT) + 1.676*(ALT)^2$$

The *p*-values based on the *t*-statistics for the linear term ($p = 0.021$) and quadratic term ($p = 0.026$) support that consideration of alternatives is related to usage of computer technology computer (see Table 14). The fitted quadratic model indicates a significant bi-polar relationship between consideration of alternatives, and usage of computer technology (see Figure 11).

**Table 14**
**Results of Regression: Usage of Computer Technology on Consideration of Alternatives**

| *Independent Variable* | *df* | *Regression Coefficient* | *t-value* | *p-value* |
|---|---|---|---|---|
| Intercept | 1 | 49.079 | 4.396 | 0.0001 |
| ALT | 1 | -14.198 | -2.393 | 0.0215 |
| $ALT^2$ | 1 | 1.676 | 2.300 | 0.0267 |




RELATIONSHIP BETWEEN USAGE OF COMPUTER TECHNOLOGY AND CONSIDERATION OF ALTERNATIVES
Figure 11

The results for $H_1$ indicate that, when the purchasing situation is represented by either straight rebuy or new buy situation, usage of computer technology in purchasing is high. Hypothesis 1 is supported. This finding for $H_1$ is consistent with previous empirical works (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981) that claim computer systems to be particularly useful for highly repetitive buying tasks such as straight rebuys.

This finding also adds a new dimension to previous research on usage of computers in purchasing by highlighting the fact that computer systems are also used for new buy situations. These results may be attributed to the unique nature of the apparel industry which can be contrasted with Original Equipment

Manufacturing (OEM) industry and other hard goods industries, the focus of the earlier studies (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981). The apparel industry, in general, is characterized by both basic, staple products and by seasonal, fashion products (Dickerson, 1991; Glock & Kunz, 1990). The use of computer technology for new buy situations can perhaps be explained, because they facilitate quick response, speedy delivery, and open communication between trading partners for changing products. On the other hand, the use of computer technology for straight rebuy situations can be explained because of automated replenishment of basic goods.

## Relationship between Selected Organizational Variables and Usage of Computer Technology

The fourth objective of this study was to examine the relationship between selected organizational variables and usage of computer technology in the fabric materials purchasing processes. Four separate hypotheses were developed to test the relationship between these organizational variables (i.e., product characteristics, centralized purchasing, vertical coordination) and the usage of computer technology, with Hypothesis 2 being written as two sub-hypotheses ($H_{2a}$, $H_{2b}$).

Product characteristics was measured by product category and demand uncertainty. Scores obtained on individual questions for demand uncertainty

were summed to create the summary variable of demand uncertainty. Centralized purchasing was measured by the location where purchasing activity was performed. The summary variable of centralized purchasing was formed by subtracting the score obtained on 'purchasing done at one central location for entire firm' from the score obtained on 'purchasing done at individual plant'. Vertical coordination was measured by frequency of communication, nature of information exchanged with suppliers, and time horizon of relationship with suppliers. Scores obtained on these individual questions were summed to create the summary variable of vertical coordination. A separate question on ownership of the supply chain was also asked to measure vertical coordination and was tested separately.

The percentage and frequency distributions for each of the selected organizational variables are reported in Table 15, Table 16, Table 18, and Table 19. Figure 12, Figure 13, and Figure 14 illustrate the percentage distributions for summary variables of demand uncertainty, centralized purchasing, and vertical coordination. Factor analysis was performed for demand uncertainty measure and vertical coordination variable, and the results are reported in Table 17 and 20 respectively.

**Table 15**
**Percentage and Frequency Distribution for Product Category**

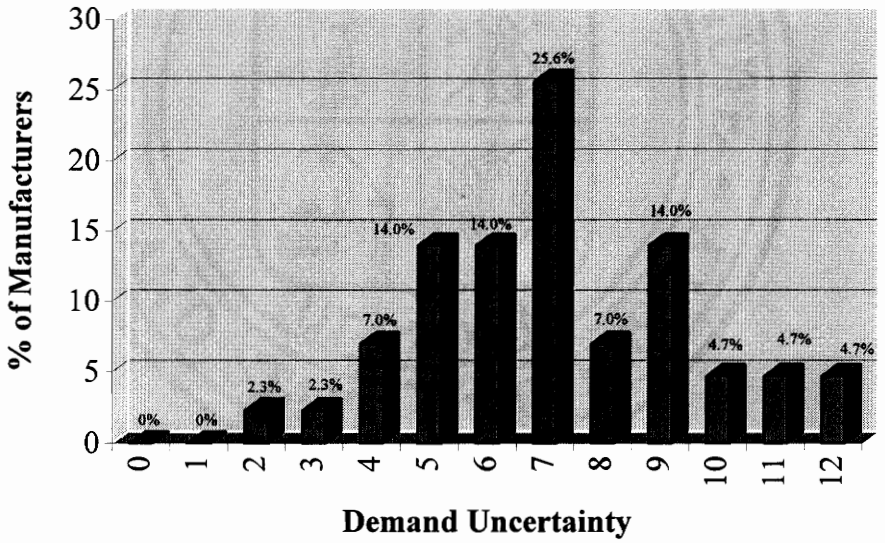
| *Measures* | *Product Category* | |
|---|---|---|
| | *n* | % |
| Men | 11 | 26.2 |
| Women | 15 | 35.7 |
| Children | 2 | 4.8 |
| Others | 14 | 33.3 |

**Table 16**
**Percentage and Frequency Distribution for Demand Uncertainty**

| *Measures* | *Demand Uncertainty* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **0** | | **1** | | **2** | | **3** | | **4** | |
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Difficult to predict demand | 4 | 9.3 | 6 | 14.0 | 20 | 46.5 | 9 | 20.9 | 4 | 9.3 |
| Seasonal demand | 1 | 2.4 | 1 | 2.4 | 15 | 36.6 | 13 | 31.7 | 11 | 26.8 |
| Frequent style changes | 2 | 4.7 | 5 | 11.6 | 19 | 44.2 | 10 | 23.3 | 7 | 16.3 |

**Table 17**
**Factor Analysis of Demand Uncertainty Measure**

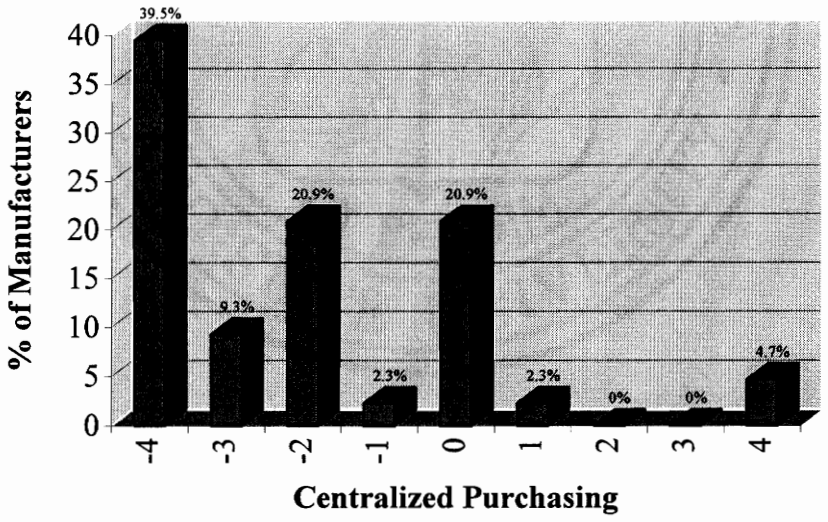
| *Factor Analysis* | *Loadings* | *Eigenvalue* | *Coefficient Alpha* |
|---|---|---|---|
| ***Demand Uncertainty*** | ***Factor 1*** | 1.60 | .55 |
| Difficult to predict demand | .67 | | |
| Seasonal demand | .79 | | |
| Frequent style changes | .72 | | |




SUMMARY VARIABLE: DEMAND UNCERTAINTY
Figure 12

**Table 18**
**Percentage and Frequency Distribution for Centralized Purchasing**

| *Location of Purchasing* | *Centralized Purchasing* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **0** | | **1** | | **2** | | **3** | | **4** | |
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| Purchasing done at individual plant basis | 15 | 36.6 | 14 | 34.1 | 4 | 9.8 | 4 | 9.8 | 4 | 9.8 |
| Purchasing done at one central location for entire firm | 2 | 4.8 | 2 | 4.8 | 2 | 4.8 | 14 | 33.3 | 22 | 52.4 |



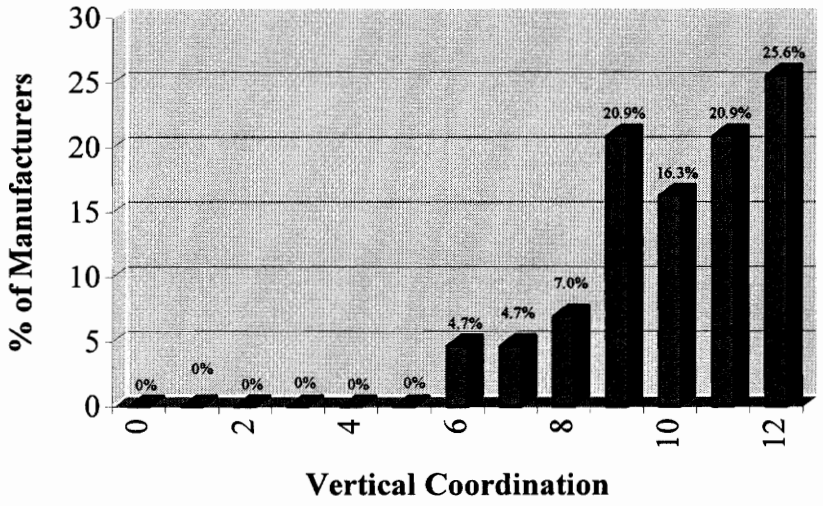

SUMMARY VARIABLE: CENTRALIZED PURCHASING
Figure 13

**Table 19**
**Percentage and Frequency Distribution for Vertical Coordination**

| *Measures* | *Vertical Coordination* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | 1 | | 2 | | 3 | | 4 | |
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Frequent communication | 0 | 0 | 0 | 0 | 3 | 7.0 | 13 | 30.2 | 27 | 62.8 |
| Information exchange | 0 | 0 | 0 | 0 | 7 | 16.3 | 21 | 48.8 | 15 | 34.9 |
| Long-term relationship | 0 | 0 | 1 | 2.3 | 3 | 7.0 | 21 | 48.8 | 18 | 41.9 |
| Ownership of the supply chain | 31 | 73.8 | 4 | 9.5 | 1 | 2.3 | 2 | 4.7 | 4 | 9.5 |

**Table 20**
**Factor Analysis of Vertical Coordination Variable**

| *Factor Analysis* | *Loadings* | *Eigenvalue* | *Coefficient Alpha* |
|---|---|---|---|
| *Vertical Coordination* | *Factor 1* | 2.14 | .79 |
| Frequent communication | .90 | | |
| Information exchange | .82 | | |
| Long-term relationship | .82 | | |




SUMMARY VARIABLE: VERTICAL COORDINATION
Figure 14

## Hypothesis $2_a$

*$H2_a$ Apparel product category is associated with the usage of computer technology in the fabric materials purchasing process.*

Hypothesis $2_a$ ($H_{2a}$) was tested using rank-based one way Analysis of Variance, also called Kruskal-Wallis test (see Table 21). This hypothesis was not confirmed ($\chi^2$ [3, $\underline{N}$ = 43] = 4.2358, $p$ = 0.2371). There is no significant statistical evidence that the median usage differs across product categories ($p$ = 0.237). Previous empirical findings (Kincade & Cassill, 1993; Ko, 1993) are inconclusive about the effect of product category on technology adoption decisions.

**Table 21**
**Kruskal-Wallis Test for Usage of Computer Technology Classified By Product Categories**

| *Product Category* | *n* | *Sum of Scores* | *Expected Under $H_0$* | *Std Dev Under $H_0$* | *Mean Score* |
|---|---|---|---|---|---|
| Women's wear | 11 | 5.0 | 5.37 | 1.44 | 0.45 |
| Men's wear | 15 | 9.0 | 7.32 | 1.58 | 0.60 |
| Children's wear | 15 | 5.0 | 7.32 | 1.58 | 0.33 |
| Others | 2 | 2.0 | 0.97 | 0.69 | 1.00 |

**Hypothesis $2_b$**

$H_{2b}$ *Demand uncertainty for apparel products is associated with the usage of computer technology in the fabric materials purchasing process.*

Ordinary Least Squares Regression Analysis was employed to examine the relationship between demand uncertainty and usage of computer technology. The following regression model with linear and quadratic terms for demand uncertainty (UNCERTAINTY) was specified to test the relationships:

$$USAGE_i = \beta_0 + \beta_1*(UNCERTAINTY)_i + \beta_2*(UNCERTAINTY)_i^2 + \in_i$$

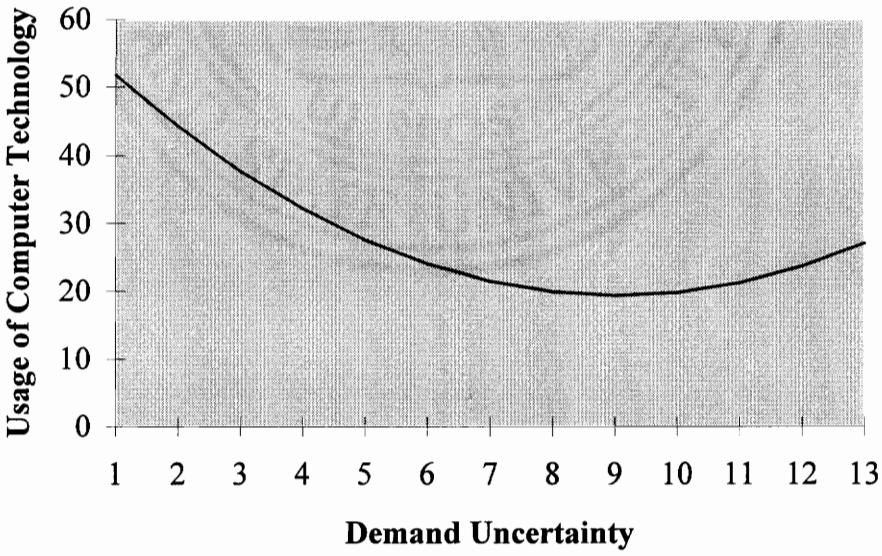
The fitted model obtained was:

$$USAGE = 51.767 - 8.035*UNCERTAINTY + 0.498*UNCERTAINTY^2$$

The respective *p*-values based on the *t*-statistics for the linear and quadratic terms for demand uncertainty ($p = 0.015$ and $p = 0.023$) support $H_{2b}$ (see Table 22). The fitted quadratic model indicates a significant bi-polar relationship between demand uncertainty and usage of computer technology (see Figure 15).

**Table 22**
**Results of Regression: Usage of Computer Technology on Demand Uncertainty**

| *Independent Variable* | *df* | *Regression Coefficient* | *t-value* | *p-value* |
|---|---|---|---|---|
| Intercept | 1 | 51.767 | 4.607 | 0.0001 |
| UNCERTAINTY | 1 | -8.035 | -2.541 | 0.015 |
| UNCERTAINTY$^2$ | 1 | 0.498 | 2.356 | 0.023 |




RELATIONSHIP BETWEEN USAGE OF COMPUTER TECHNOLOGY AND DEMAND UNCERTAINTY
Figure 15

The findings for $H_{2b}$ indicate that usage of computer technology is high for firms who reported either a low or high demand uncertainty, and usage of computer technology is low for firms whose uncertainty is moderate. A portion of this finding is consistent with previous findings on the relationship between demand uncertainty and adoption of technological innovations. Gatignon and Robertson (1989) found high demand uncertainty to be an important predictor of innovation adoption. The result of the present research adds a new dimension to earlier empirical works by suggesting that low demand uncertainty also significantly affects usage of computer technology in purchasing functions. This finding can be attributed to the fact that when there is low demand uncertainty, purchases can be routinized and therefore computerized. With the absence of any demand fluctuations, purchases can be made on a regular basis on pre-established specifications (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981).

**Hypothesis 3**

*$H_3$ The degree of centralization in purchasing of fabric materials is associated with the usage of computer technology in the fabric materials purchasing process.*

Ordinary Least Squares Regression Analysis was employed to examine the relationship between centralized purchasing (CENTRALIZATION) and usage of computer technology (USAGE). The following regression model with linear and quadratic terms for centralized purchasing was specified to test the relationship:

$$USAGE_i = \beta_0*(CENTRALIZATION)_i + \beta_1*(CENTRALIZATION)_i^2 + \in_i$$

The fitted model obtained was as follows:

$$USAGE = 20.802 + 0.467*CENTRALIZATION + 0.303*CENTRALIZATION^2$$

The respective *p*-values based on the *t*-statistics for the linear and quadratic terms for centralized purchasing ($p = 0.599$ and $p = 0.270$) do not support $H_3$ (see Table 23). The failure to find expected statistical significance may result from a variety of reasons, including the lack of diversity among respondents on the centralized purchasing measure (see Figure 13). Moderating factors, such as the type of innovation in consideration, might also be affecting adoption of innovation as suggested by earlier empirical works (Kimberly & Evaneski, 1981).

**Table 23**
**Results of Regression: Usage of Computer Technology on Centralized Purchasing**

| *Independent Variable* | *df* | *Regression Coefficient* | *t-value* | *p-value* |
|---|---|---|---|---|
| Intercept | 1 | 20.802 | 8.173 | 0.0001 |
| CENTRALIZATION | 1 | 0.467 | 0.529 | 0.5998 |
| CENTRALIZATION$^2$ | 1 | 0.303 | 1.116 | 0.2708 |

**Hypothesis 4**

*$H_4$: The degree of vertical coordination with suppliers is positively associated with the usage of computer technology in the fabric materials purchasing process.*

A one-sided (right tailed) Spearman's Correlation test was performed to test the relationship between vertical coordination and usage of computer technology (see Table 24). The findings do not support the hypothesis that usage of computer technology is affected by vertical coordination ($r_s$ = 0.16950, $p$ = 0.138). Ownership of the supply chain as a measure of vertical coordination approaches significance ($r_s$ = 0.23309, $p$ = 0.065). These findings do not completely support earlier research findings which report vertical coordination to be an important predictor of technological adoption (Ettlie & Reza, 1992;

Gatignon & Robertson, 1989; Robertson & Gatignon, 1986). The underlying reason for the findings being contrary to previous research could be a lack of variety among the respondents (see Figure 14 and Table 19).

**Table 24**
**Spearman's Correlation Test of Usage versus Vertical Coordination**

| *Variables* | *n* | *Mean* | *Std Dev* | *Median* | *Minimum* |
|---|---|---|---|---|---|
| Vertical coordination | 10.04 | 1.71 | 9.95 | 23.00 | 6.00 |
| Ownership of the supply chain | 42 | 0.66 | 1.31 | 0 | 0 |
| Usage of computer technology | 43 | 22.48 | 9.95 | 23.00 | 6.00 |

## Relationship between Usage of Computer Technology and Purchasing Performance

The fifth objective of the research was to examine the relationship between usage of computer technology in the fabric materials purchasing process and purchasing performance. This relationship was tested with Hypothesis 5 ($H_5$). Purchasing performance was measured by cost-effectiveness (i.e., possession cost: [frequent shipment of orders, size of shipment, inventory turnover]; acquisition cost: [defect free orders, orders meeting specifications, orders delivered on time]; invoice cost: [paper-work free orders]). The percentage and frequency distributions for purchasing performance measure is reported in Table 25. Factor analysis was performed on the questions for acquisition cost. Factor 1

captured all three questions: defect free orders, orders meeting specifications, and orders delivered on time, indicating the reliability of grouping the three questions together (see Table 26). The percentages for the three questions on acquisition cost were averaged together to create a single measure for acquisition cost.

**Table 25**
**Percentage and Frequency Distribution Purchasing Performance Measure**

| *Cost-effectiveness* | *Purchasing Performance* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Possession Cost*** | | | | | | | | | | |
| | **0** | | **1** | | **2** | | **3** | | **4** | |
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Frequent shipment of orders | 1 | 2.3 | 0 | 0 | 2 | 4.7 | 7 | 16.3 | 33 | 76.7 |
| Size of shipment | 24 | 57.1 | 7 | 16.7 | 10 | 23.8 | 1 | 2.4 | 0 | 0 |
| | | | | | | | | | | |
| | **0-15** | | **16-30** | | **31-45** | | **46-60** | | | |
| | *n* | % | *n* | % | *n* | % | *n* | % | | |
| Inventory turnover | 24 | 88.8 | 2 | 7.4 | 0 | 0 | 1 | 3.7 | | |
| ***Acquisition Cost*** | | | | | | | | | | |
| | **0-25** | | **26-50** | | **51-75** | | **76-100** | | | |
| | *n* | % | *n* | % | *n* | % | *n* | % | | |
| Defect-free orders | 3 | 7.9 | 1 | 2.6 | 4 | 10.5 | 30 | 79 | | |
| Orders meeting specifications | 0 | 0 | 0 | 0 | 4 | 10.3 | 35 | 89.8 | | |
| Orders delivered on time | 0 | 0 | 3 | 7.5 | 7 | 17.5 | 30 | 75 | | |
| ***Invoice Cost*** | | | | | | | | | | |
| Paper-work free orders | 33 | 91.7 | 2 | 5.6 | 0 | 0 | 1 | 2.8 | | |

**Table 26**
**Factor Analysis of Acquisition Cost Measure**

| *Factor Analysis* | *Loadings* | *Eigenvalue* | *Coefficient Alpha* |
|---|---|---|---|
| *Acquisition Cost* | ***Factor 1*** | 1.93 | .41 |
| Defect free fabrics orders | .74 | | |
| Orders meeting specifications | .93 | | |
| Orders delivered on time | .72 | | |

**Hypothesis 5**

*$H_5$ Usage of computer technology in the fabric materials purchasing process is positively related to purchasing performance.*

The relationship between usage of computer technology in the fabric materials purchasing process and purchasing performance was examined using Analysis of Variance. Separate ANOVA tests were administered for each question on possession cost. The results of ANOVA F-test for frequent shipment of orders ($F$ [24, 43] = 1.77, $p$ = 0.10) approaches significance, and the result of ANOVA F-test for size of shipment ($F$ [24, 42] = 1.13, $p$ = 0.40) was not significant. Inventory turnover, as a measure of possession cost ($F$ [19, 27] = 3.53, $p$ = 0.04), was significantly related to usage of computer technology in purchasing. Respondents who used computer technology for fabric materials purchasing relied on frequent shipment of orders and had high inventory turnover (see Table 27).

**Table 27**
**Means of Frequent Shipment of Orders and Inventory Turnover Classified by Usage of Computer Technology**

| *Usage of Computer Technology (Scores)* | *Frequent Shipment of Orders (Means)* | | *Inventory Turnover (Means)* | |
|---|---|---|---|---|
| | *n* | | *n* | |
| 0-11 | 5 | 3.1 | 5 | 6.9 |
| 12-24 | 9 | 3.2 | 8 | 4.8 |
| 25-36 | 8 | 3.7 | 4 | 12.8 |
| 37-48 | 3 | 3.8 | 3 | 7.2 |

This finding can be interpreted to mean that usage of computer technology is associated with low possession cost. When there are frequent shipment of orders and high inventory turns, orders can be placed on need basis. There is reduced need to carry inventory; therefore possession costs are low.

Acquisition cost was also tested using Analysis of Variance. The percentages for the three questions on acquisition cost were averaged together to create a single measure for acquisition cost. The results of ANOVA F-test for acquisition cost ($F\ [23, 40] = 0.67$, $p = 0.81$) indicate that acquisition cost is not affected by usage of computer technology in fabric materials purchasing, which is contrary to the findings of previous empirical studies (Hannaford, 1983; Sriram & Banerjee, 1994). Table 28 reports the means of acquisition cost by usage of computer technology.

**Table 28**
**Means of Acquisition Cost Classified by Usage of Computer Technology**

| *Usage of Computer Technology (Scores)* | *Acquisition Cost (Means)* | |
|---|---|---|
| | *(n)* | |
| 0-11 | 5 | 89.0 |
| 12-24 | 8 | 82.3 |
| 25-36 | 8 | 86.4 |
| 37-48 | 3 | 93.2 |

Invoice cost is affected by usage of computer technology in fabric materials purchasing (F [22,36] = 4.83, $p$ = 0.002). As paper-work free transactions increase, invoice costs are lowered. These findings reveal that paper-work free purchasing transactions occur between trading partners that are using computer technology in fabric materials purchasing (see Table 29).

**Table 29**
**Means of Invoice Cost Classified by Usage of Computer Technology**

| *Usage of Computer Technology (Scores)* | *Invoice Cost (Means)* | |
|---|---|---|
| | *(n)* | |
| 0-11 | 4 | 0 |
| 12-24 | 8 | 2.5 |
| 25-36 | 8 | 16.8 |
| 37-48 | 3 | 8.3 |

These findings can also be interpreted to mean that usage of computer technology in fabric materials purchasing may reduce invoice cost because it

facilitates paper-work free transactions (Carter & Ragatz, 1991; Lalonde & Emmelhainz, 1981; Sriram & Banerjee, 1994).

# CHAPTER VI

## Summary, Conclusions, Implications, and Recommendations

### Summary and Conclusions

The purchasing processes of many industrial organizations have recently undergone fundamental changes with the use of computers for buying materials and supplies, computing order quantities, and keeping inventory figures (Corman, 1990). Electronic communication between apparel manufacturers and their trading partners can facilitate consumer responsiveness given the fast-changing nature of the apparel industry (Glock & Kunz, 1990; Solinger, 1988). Speed and responsiveness can be used as a strategy for differentiation and the establishment of competitive edge by apparel manufacturers.

This study was designed to examine the relationship between selected organizational factors of apparel manufacturing firms, firms' usage of computer technology in the fabric materials purchasing process, and firms' purchasing performance. The conceptual framework for this study was based on the Robinson, Faris and Wind (1967) buygrid framework; Rogers' adoption theory (1983); and the Noordewier, John, and Nevin (1990) empirical work. A factor approach was used to achieve the objectives of this study, and a cross-section of

firms was examined to determine significant variables related to the usage of computer technology in purchasing functions.

The sample consisted of 118 apparel manufacturers. The "Top 100 Sewn Products Companies '95", published in the Apparel Industry Magazine, and Dun's Business Rankings 1995 constituted the source for the sample. The survey method was used to collect the data, and questionnaires were mailed to purchasing managers of the selected firms in the sample. Prior to the mailing, the questionnaire was pilot tested with purchasing managers of two large-size apparel manufacturing firms and with a group of secretaries at Virginia Tech who were involved with purchasing activities. Forty-three responses were received with a response rate of 38%. Regression, Correlation, and Analysis of Variance were used to test the statistical significance of hypothesized relationships.

**Demographic Profile of the Respondents**

Among the respondents, 35.7% of the manufacturers represented women's wear firms, 26.2% of the manufacturers represented men's wear firms, and 4.8% of the manufacturers represented children's wear firms. The others category constituted 33.3% of the manufacturers. This latter finding is consistent with the general profile of the U. S. apparel manufacturers (Dickerson, 1991) and

indicates the prevalence of niche categories (Kincade & Cassill, 1993). Most of the firms in the sample employed between 1000 to 4999 workers (43.6%) and had their annual sales volume in the range of $50 to $149M (25%).

**Usage of Computer Technology**

The usage of computer technology in the fabric materials purchasing process was measured by determining if computers were being used in conducting twelve purchasing activities. The usage of computer technology in fabric materials purchasing differed for apparel manufacturers. The most common purchasing activities, for which computers were being used, were: determining the quantity of needed fabric, describing the needed fabric, preparing purchase order, monitoring purchase order status, and recording vendor history. Computer technology was used very little for searching for supplier sources, requesting price quotations, transmitting and expediting purchase orders, sending invoices, and evaluating buyer and vendor performances. These findings suggests that inter-company business documents are not transmitted or exchanged over computers using telecommunication lines by apparel companies. This finding could probably be related to the low usage rate of such standard document formats as TALC, FASLINC, and ANSI standards among apparel firms.

## Relationship between Types of Purchasing Situations and Usage of Computer Technology

Straight rebuy, modified rebuy, and new buy situations were hypothesized to be related to usage of computer technology ($H_1$). Straight rebuy situations and new buy situations were both expected to use high levels of computer in purchasing functions. Types of purchasing situations were measured along two dimensions: newness of task and information requirements, and consideration of alternatives. Ordinary least squares regression analysis confirmed the relationship between these variables in support of the Robinson, Faris, and Wind (1967) framework. In addition, it was found that purchasing situation and usage of computer technology had a bi-polar relationship. These findings showed usage of computers for new buy situations, as well as straight rebuy situations. This finding may be attributed to the bi-polar characteristic of the apparel product (Dickerson, 1991; Glock & Kunz, 1991). Manufacturers may automate purchasing processes for quick response and fast delivery of fashion products and for speed in reorder of basic goods.

## Relationship between Selected Organizational Variables and Usage of Computer Technology

Selected organizational variables of product characteristics, centralized purchasing, and vertical coordination were hypothesized to be related to the

usage of computer technology in the fabric materials purchasing process ($H_{2a}$ $H_{2b}$, $H_3$, and $H_4$).

The variable, product characteristics, was measured with product category and demand uncertainty. Rank based one-way Analysis of Variance did not confirm product category to be related to usage of computer technology ($H_{2a}$). These findings further add to the inconclusive results of Kincade (1989) and Ko (1993) on the effects of product characteristics on QR technology adoption. Ordinary least squares regression analysis confirmed demand uncertainty to be related to usage of computer technology ($H_{2b}$), (Gatignon & Robertson, 1989; Robertson & Gatignon, 1986). A bi-polar relationship was found between demand uncertainty variable and usage of computer technology, with both low and high demand uncertainty related to higher usage of computer technology. This finding may be attributed to the fact that, when there is low demand uncertainty, purchases can be made on pre-established specifications. With the absence of any demand fluctuations, purchases can be routinized and therefore computerized (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981). With high uncertainty in demand, purchasing transactions can be computerized to facilitate quick response, speedy delivery, and open communication between manufacturers and their suppliers dealing with high fashion goods.

Although centralized purchasing is related to technology adoption in some empirical studies (Fearon, 1989; Hutt & Speh, 1992), regression analysis did not confirm this hypothesis ($H_3$). These results add to the previously inconclusive findings in empirical literature (Damanpour, 1992; Ettlie et al., 1984; Kimberly & Evaneski, 1981) on organizational centralization and innovation adoption, and need to be further analyzed. Moderating factors such as the type of innovation in consideration may affect the adoption of innovation (Kimberly & Evaneski, 1981). A lack of variety among the respondents on the centralized purchasing variable could also have resulted in the failure to find support for Hypothesis 3. Most respondents reported centralized purchasing.

One-sided Spearman's Correlation conducted to test $H_4$ did not confirm the relationship between vertical coordination and usage of computer technology in the fabric materials purchasing process, despite supporting evidence in literature (Ettlie & Reza, 1992; Gatignon & Robertson, 1989; Robertson & Gatignon, 1986). The underlying reason for the findings being contrary to previous research could be because of a lack of diversity among respondents. Most respondents reported high levels of vertical coordination.

## Relationship between Usage of Computer Technology and Purchasing Performance

Purchasing performance was measured by cost effectiveness. Analysis of Variance confirmed that possession cost and invoice cost were affected by the usage of computer technology. Computerization allows for frequent shipment of orders and high inventory turns; therefore orders can be placed on need basis. Computerized transaction reduces the need to carry inventory, thereby lowering possession costs. By facilitating paper-work free transactions, invoice costs can be lowered by the usage of computer technology in fabric materials purchasing. Acquisition costs however, were not related to usage of computer technology. This result can partially be explained by the respondents' unwillingness to depict their company in an unfavorable light, and their reluctance to report low percentage figures for performance measures. Hypothesis 5 was only partially supported.

## Implications

The results of this study provide a foundation for conducting subsequent research on purchasing related issues within the apparel industry. The typology of purchasing situations developed for large-size apparel manufacturing firms can be tested for applicability to medium and small-size apparel manufacturing

firms. The classification of purchasing situations could also be tested from apparel retailers' perspective.

A significant contribution of this research was the development of a measure for product characteristics. The uncertainty of demand for apparel products was measured on a scale of zero to four, with the following questions: difficulty in predicting/forecasting demand, seasonal demand, and frequency of style changes on apparel products. Measures for seasonality and fashion change in previous research were reported to be inadequate measures and did not discriminate as expected (Kincade & Cassill, 1993; Ko, 1993). Product characteristics of apparel items can be identified with demand uncertainty used in this research and can be used in future research on apparel firms.

## Recommendations for Future Research

The hypotheses that were not confirmed or partially supported in this study could be re-examined for the apparel industry. A lack of diversity in the responses given by apparel manufacturers may be an underlying reason for some of the nonsignificant results of this study. Additional research with a broader spectrum of respondents could be employed to investigate the relationship. The same variables can also be analyzed using a qualitative method of study to probe for other variables that may be affecting computer usage.

This study focused solely on fabric materials purchasing activities. Future research could encompass all production materials for apparel (i.e., piece-goods and findings), equipment and maintenance items.

Further research could be done to more closely examine the profile of the textile manufacturers, and the relationship of the textile manufacturers with their suppliers. Trade literature indicates that apparel manufacturers and their suppliers are not computerizing at the same rate as the textile manufacturers and their suppliers. Lack of computer usage in some areas indicate barriers to their adoption. There are cost and time efficiencies associated with computer usage, and apparel manufacturers could be helped by further investigation of barriers.

Future research can also be conducted on the effects of usage of computer technology on firms purchasing performance in relation to the cost associated with usage of computer technology. A comparative analysis between the cost and benefits of usage of computer technology in purchasing could be undertaken.

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# APPENDICES

## APPENDIX A
## Institutional Review Board Approval

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Research and Graduate Studies

Office of the Associate Provost for Research
306 Burruss Hall
Blacksburg, VA 24061-0244
(540) 231-9359 FAX: (540) 231-7522

MEMORANDUM

TO: Sarita Priyadarshi
Clothing and Textiles

FROM: Ernest R. Stout
Associate Provost for Research

DATE: October 23, 1995

SUBJECT: IRB EXPEDITED APPROVAL/"Adoption of Computer Technology in Materials Purchasing in the Apparel Industry" Ref. 95-239

I have reviewed your request to the IRB for the above referenced project. I concur with Dr. Kincade that the experiments are of minimal risk to the human subjects who will participate and that appropriate safeguards have been taken. The IRB has determined that each subject should receive a complete copy of the signed Informed Consent.

This approval is valid for 12 months. If the involvement with human subjects is not complete within 12 months, the project must be resubmitted for re-approval. We will prompt you about 10 months from now. If there are significant changes in the protocol involving human subjects, those changes must be approved before proceeding.

On behalf of the Institutional Review Board for Research Involving Human Subjects, I have given your request expedited approval.

Best wishes.

ERS/php

c: Dr. Kincade

## APPENDIX B
## Cover letter for the questionnaire

Purchasing Manager
Company
Street Address
City, State, Zip code

January 4, 1996

SALUTATION:

I am a graduate student at Virginia Tech, conducting research on the "Usage of Computer Technology in Fabric Materials Purchasing by Large-Size Apparel Manufacturing Firms". The apparel industry has recently seen an upsurge in the need for technical information and analysis. As a part of my thesis I am asking you to contribute to this information.

The enclosed survey asks about the purchasing policies of your company, and relationships with your suppliers. It can be completed in less than 10 minutes. You are free to omit any question on the survey. The answers to the questions will remain confidential. I will not be able to identify your company because the envelops will be separated from the survey before reaching me.

Please return the completed survey by **January 18, 1996**. I realize your time is of importance, but the success of this important study will depend on your response. If you wish to receive an executive summary of the study, please indicate this on the back of the envelope. The results will be mailed to you within the next few months. If you have any questions about this research, please contact Dr. Doris Kincade at (540) 231-6379. If you have any questions about the conduct of this research, please contact Dr. Ernest Stout, Research Division at (540) 231-6077. The study has been approved by the university IRB.

Thank you for your time and cooperation,

Sincerely,

Sarita Priyadarshi
Graduate Student

Doris Kincade, Ph. D.
Assistant Professor

# APPENDIX C
## Questionnaire for Apparel Manufacturers

**This questionnaire is for a study of apparel manufacturers' purchase of fabric for use in producing apparel. Please circle one best answer per question, with respect to your firm.**

**SECTION I: Circle the best answer.**

| | Never | | | | Always |
|---|---|---|---|---|---|
| 1. How often is the fabric purchase a reorder for your firm? | 0 | 1 | 2 | 3 | 4 |
| 2. How often does your firm order fabric with requirements the same as previous orders? | 0 | 1 | 2 | 3 | 4 |
| 3. How often are the fabric requirements for an order different in characteristics from your firm's most recent previous purchase of fabric? | 0 | 1 | 2 | 3 | 4 |
| 4. How often does your firm have complete knowledge of fabric characteristics needed, before placing an order for fabric? | 0 | 1 | 2 | 3 | 4 |
| 5. How often does the purchase of fabric materials require a significant amount of new information? | 0 | 1 | 2 | 3 | 4 |
| 6. How often does your firm consider changing the present supplier of fabric materials? | 0 | 1 | 2 | 3 | 4 |
| 7. How often does your firm consider buying alternative fabrics that it has never bought before? | 0 | 1 | 2 | 3 | 4 |

**SECTION II: Circle the best answer.**

1. How often does your firm use **computers** to perform the following fabric purchasing activities?

| | Never | | | | Always |
|---|---|---|---|---|---|
| (a) determine quantity of needed fabric | 0 | 1 | 2 | 3 | 4 |
| (b) description of the needed fabric | 0 | 1 | 2 | 3 | 4 |
| (c) search for supplier sources | 0 | 1 | 2 | 3 | 4 |
| (d) request for price quotations | 0 | 1 | 2 | 3 | 4 |
| (e) preparation of purchase order | 0 | 1 | 2 | 3 | 4 |
| (f) transmission of purchase order | 0 | 1 | 2 | 3 | 4 |
| (g) expedite purchase order | 0 | 1 | 2 | 3 | 4 |
| (h) monitor purchase order status | 0 | 1 | 2 | 3 | 4 |
| (i) send invoices | 0 | 1 | 2 | 3 | 4 |
| (j) buyer performance evaluation | 0 | 1 | 2 | 3 | 4 |
| (k) vendor performance evaluation | 0 | 1 | 2 | 3 | 4 |
| (l) vendor history recording | 0 | 1 | 2 | 3 | 4 |

2. Indicate your firm's usage of computers in the following fabric purchasing activities.
**Check all boxes that apply.**

| | Not Applicable | Within Purchasing Dept. | Firm-wide | With Vendors |
|---|---|---|---|---|
| (a) determine quantity of needed fabric | ❑ | ❑ | ❑ | ❑ |
| (b) description of the needed fabric | ❑ | ❑ | ❑ | ❑ |
| (c) search for supplier sources | ❑ | ❑ | ❑ | ❑ |
| (d) request for price quotations | ❑ | ❑ | ❑ | ❑ |
| (e) preparation of purchase order | ❑ | ❑ | ❑ | ❑ |
| (f) transmission of purchase order | ❑ | ❑ | ❑ | ❑ |
| (g) expedite purchase order | ❑ | ❑ | ❑ | ❑ |
| (h) monitor purchase order status | ❑ | ❑ | ❑ | ❑ |
| (i) send invoices | ❑ | ❑ | ❑ | ❑ |
| (j) buyer performance evaluation | ❑ | ❑ | ❑ | ❑ |
| (k) vendor performance evaluation | ❑ | ❑ | ❑ | ❑ |
| (l) vendor history recording | ❑ | ❑ | ❑ | ❑ |

3. What technology does your firm use for communicating the following purchasing information?
**Check all that apply.**

| | Telephone (voice) | Telex / Fax | Mail | Supplier-generated computer print-outs | Terminal-to Computer | Computer-to Computer |
|---|---|---|---|---|---|---|
| (a) product availability/ delivery dates | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| (b) pricing information | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| (c) purchase orders | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| (d) expediting | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| (e) status reporting | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| (f) invoice payment | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

**SECTION III: Circle the best answer.**

| | Never | | | | Always |
|---|---|---|---|---|---|
| 1. How often is purchasing done on an individual -plant basis? | 0 | 1 | 2 | 3 | 4 |
| 2. How often is purchasing done at one central location for the entire firm? | 0 | 1 | 2 | 3 | 4 |

**SECTION IV: Circle the best answer.**

| | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|
| 1. Your firm and its fabric suppliers (internal or external) have frequent communication. | 0 | 1 | 2 | 3 | 4 |
| 2. Information exchanged between your firm and its fabric suppliers (internal or external) is production and logistics related. | 0 | 1 | 2 | 3 | 4 |
| 3. Your firm and its fabric suppliers (internal or external) share a long-term relationship. | 0 | 1 | 2 | 3 | 4 |
| 4. Your firm is vertically integrated (i.e., owns fabric mills or other suppliers). | 0 | 1 | 2 | 3 | 4 |
| 5. Your firm uses TALC or FASLINC standards | 0 | 1 | 2 | 3 | 4 |
| 6. Your firm uses ANSI standards | 0 | 1 | 2 | 3 | 4 |
| 7. Your firm receives frequent shipments of purchased fabrics | 0 | 1 | 2 | 3 | 4 |
| 8. The size of your firm's fabric shipments are small | 0 | 1 | 2 | 3 | 4 |
| 9. The demand for your firm's end-products is difficult to predict/forecast. | 0 | 1 | 2 | 3 | 4 |
| 10. The demand for your firm's end-product is based on the time-period of the year. | 0 | 1 | 2 | 3 | 4 |
| 11. Your firm's end-products have frequent style changes. | 0 | 1 | 2 | 3 | 4 |

**SECTION V: Answer as accurately as possible**

1. On average, what is the annual inventory turnover of fabric materials bought from your firm's suppliers? _____ **turns/year**

2. On average, what percentage of your firm's fabrics are:

(a) defect free _____%

(b) meeting specifications _____%

(c) delivered on time _____%

(d) paperwork-free _____%

3. What is the major product category that your firm manufactures in terms of sales volume? **Circle the best answer.**

1. women's wear
2. men's wear
3. children's wear
4. others (specify) _____

4. What is your firm's annual gross sales figure in dollars? **Circle the best answer.**

1. under $50 million
2. $50 - $149 million
3. $150 - $249 million
4. $250 - $499 million
5. $500 - $999 million
6. $1 billion and over

5. How many hourly employees does your firm have? **Circle the best answer.**

1. fewer than 500
2. 500 - 999
3. 1000 - 4999
4. 5000 or above

6. What is the scope of your fabric purchasing responsibility? **Circle the best answer.**

1. firm-wide
2. division of the firm
3. department within the plant
4. other (specify) _____

**!!! Thank you for your Participation!!!**

## APPENDIX D
## Follow-up Postcard

January 10, 1996

Last week a questionnaire was mailed to you asking you about your companies purchasing policies. If you have already returned it to me, please accept my deep thanks. If not, please complete and return the questionnaire. It is extremely important to have your response for the benefits of apparel manufacturers as well as my thesis. If you did not receive the questionnaire, please call me at (540) 951-8517 and I will send another one to you.

Sincerely,

Sarita Priyadarshi, Master's student at Virginia Tech

Doris Kincade, Assistant Professor at Virginia Tech

**SUPPLEMENT**

**Manuscript for Publication in the Clothing and Textiles Research Journal**

## Introduction

The U. S. apparel industry is characterized by changing products and fashion. The life cycle of many apparel products is short and demand is volatile, with moderate to high uncertainty in demand. Speed and responsiveness can be used as a strategy for differentiation and establishment of a competitive edge by apparel manufacturers and retailers alike. Faster, more responsive vendors can outperform low cost but slower sources (Gilreath, Reeve & Whalen Jr., 1995). Today, an increasing number of apparel manufacturers are adopting the Quick Response (QR) business strategy coupled with Just-in-Time (JIT) manufacturing and purchasing strategies to meet the demands of their customers quickly. The adoption of computerized purchasing systems can help in fully implementing the QR and JIT manufacturing and purchasing strategies by transmitting purchase orders instantaneously, by expediting orders, and by providing small order flexibility (DesMarteau, 1995).

The buying process of many industrial organizations has undergone fundamental changes with the use of computers for purchasing materials and supplies, keeping current inventory figures, and computing economical order quantities (Corman, 1990; Kotler, 1983). Electronic ordering provides computer

to computer linkages between firms, enabling them to exchange business information, conduct purchase transactions, and send invoices and inter-company documents (Kotler & Armstrong, 1994). These systems eliminate manual and clerical work in business processes, thereby eliminating the need for paper work and high personnel requirements. Slow responsiveness to consumers also can be eliminated, because firms can instantaneously process and deliver orders. In addition, the concepts of inventory reduction and cost effectiveness can be realized by the adoption of electronic ordering. Stronger business partnerships can be formed between firms, because communication is facilitated.

With improved purchasing technology, organizational buyers are in a better position to make intelligent decisions, because they can carefully analyze their buying decisions (Corman, 1990). Computers also are used to assist buyers in making informed vendor selection decisions through the use of an automated database. The performance of the vendor and the buyer can be evaluated by the data in the computer. With increased competition, where suppliers often rate equally on price, quality and service, the suppliers who offer technological linkage have a greater propensity to be selected by the buyers (Hutt & Speh, 1992; Miller, 1992). Proper timing of delivery and expediting of the purchase

order, which are very important elements in buying, can be well handled by the use of computers in purchasing.

Although the apparel industry has been characterized by relatively simple technology since its evolution, the industry today is experiencing innovations in its production processes with the use of computer aided design (CAD), computer aided manufacturing (CAM), and Unit Production Systems (UPS). Management functions such as maintaining payroll and billing can now be computerized, and a closer link between the production and marketing chains is possible with the use of computers and automation (Dickerson, 1991). The purchasing functions of the apparel manufacturing and retailing industry also are being computerized with the adoption of Electronic Data Interchange (EDI) and by automation of the ordering process.

Despite the increases in available technology and proven savings in other industries (Hutt & Speh, 1992), adoption of computerized purchasing technologies among apparel manufacturers remains low. The usage level of computer technology in the apparel industry for materials purchasing remains undetermined. The purpose of the present research is to examine the fabric materials purchasing process of apparel manufacturing firms.

## Related Research

### The Buygrid Framework

Robinson, Faris, and Wind (1967) identified and examined the three types of purchasing situations or buyclasses. The buyclass variables presented by them represent a continuum ranging from the purchase of products that the firm has not previously purchased to the purchase of products the firm buys on a routine basis. The purchasing situations are classified according to three primary criteria: the newness of the problem and the extent to which the buyers possess relevant past buying experiences, the amount and type of information required by the buyers before they can make a final buying decision with confidence, and the number of new alternatives that are considered by the buyers before making the final buying decision. Empirical studies on the usage of computer technology in purchasing have found that the straight rebuy situation is most likely to involve computerization, because items are bought regularly on pre-established specifications (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981).

The buygrid model develops a useful taxonomy and makes testable propositions. Empirical studies have been conducted on the buygrid model to test its validity; however, there is no consensus of opinion among the researchers on the applicability of the model in buying decision making. Bellizzi and McVey

(1983) found the buyclass variables (i.e., new task, modified rebuy, straight rebuy) to be nonsignificant in predicting the influence of individuals on industrial buying, although the importance of these variables was manifested in the amount of information sought in making purchase decisions. Others found the buyclass variables to exercise significant influence on the buying process (Anderson, Chu, & Weitz, 1987; Ginghold, 1986; Matthyssens & Faes, 1985). Information needs, consideration of alternative choices, and newness of the task were the dimensions studied for the three buy situations. New task was found to be high on all the three dimensions, and straight rebuy was low on all three dimensions. The modified rebuy was midrange on all the three dimensions.

**Use of Computers in Purchasing**

Purchasing departments are making greater use of computers. Parasuraman (1981) found that 53% of a sample of purchasing function employees used computers in some aspects of purchasing activities. Lalonde and Emmelhainz (1985) found an increase in computer use by purchasing personnel. A 1987 survey by Purchasing Magazine found that 88% of purchasing personnel used computers for some aspect of their work. Plank, Reid, Kijewski, and Lim (1992) examined the use of computers by purchasing departments and reported 98.2% usage rate for computers. Computers were used mainly to maintain inventory records and vendor lists and to monitor purchase orders, but had

limited use for material resource planning (MRP), analyzing vendor ratings, and selecting vendors (Parasuraman, 1981).

A computer system is especially useful in highly repetitive buying tasks such as straight rebuys (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews, Wilson, & Blackhaus, 1977; Parasuraman, 1981). Routine purchases can be handled faster and more economically by the computer than by the purchasing staff (Hutt & Speh, 1992). In the case of a continuing need for standard items, supplies or materials that are bought on a regular basis on pre-established specifications (i.e., straight rebuy), orders can be transmitted directly to the supplier by entering the order directly into the computer (Hill, Alexander, & Cross, 1975; Kotler & Armstrong, 1994).

**Objectives**

The specific objectives of the research were:

(1) To determine the types of purchasing situations for fabric materials among the apparel manufacturing firms.

(2) To identify the usage of computer technology in the fabric materials purchasing process among the apparel manufacturing firms.

(3) To examine the relationship between type of purchasing situation and usage of computer technology in the fabric materials purchasing process.

**Research Design**

This research followed the analytical survey method, and data were collected using mail questionnaires. A large and dispersed sample can be obtained by using mail questionnaires, which precludes the use of personal interviews. The comprehensiveness of the questionnaire precludes the use of telephone interviews. The case study method was not considered since this method limits the generalizability of the research results to a larger population (Kerlinger, 1973).

This study used the factor approach as opposed to the process approach to examine the usage of computer technology in the fabric materials purchasing process for apparel manufacturing firms. The factor approach examines a cross-section of firms to determine the significant characteristics which influence adoption (Lefebvre, Harvey, & Lefebvre, 1991; Masters et al., 1992; O'Callaghan, Kaufmann, & Konsynski, 1992).

**Sample Selection**

The population for this study consisted of large U.S. apparel manufacturers. The Top 100 Sewn Products Companies for the year 1995, as published in the Apparel Industry Magazine (AIM), was used for the sample (Baird, 1995). This list was supplemented by Dun's Business Rankings (1995). The two lists were categorized by each firm's total revenue and were composed

of both public and private apparel companies. More than 200 sewn products companies were surveyed by AIM to compile the Top 100 Sewn Products Companies. Additional information about the top 100 companies was obtained from annual reports, 10-K's, published reports, and other industry sources (Baird, 1995).

**Instrument**

A mail questionnaire was used to collect the data. The questionnaire consisted of questions related to purchasing situations of apparel manufacturers and usage of computer technology.

**Purchasing Situation**

The purchasing situation, as represented by the buyclass variables of straight rebuy, modified rebuy, and new-buy, was measured by the dimensions of: information requirements, newness of task, and consideration of alternatives. The respondents were asked to rate the information requirements, newness of task, and consideration of alternatives on a scale of 0 (never) to 4 (always).

**Usage of Computer Technology**

The usage of computer technology was measured by the firms' usage of computers to conduct the following 12 purchasing activities: determine the quantity of the needed item, describe the characteristics of the needed item, search for supplier sources, request for price quotations, prepare purchase

orders, transmit purchase orders, expedite, monitor purchase order status, send invoices, record vendor history, evaluate buyer performance, and evaluate vendor performance. The respondents were asked to report their usage level of computers by indicating on the following scale: 0 (never) to 4 (always) and summation scores ranged from 0 to 48. A coefficient alpha test was performed to evaluate the reliability of the usage of computer technology measure.

**Data Collection**

Questionnaires were mailed to the purchasing managers of 118 apparel manufacturing firms. The mailing process followed the procedure used by Kincade (1989) and Ko (1993). The initial mailing packet included a cover letter mentioning the purpose of the research and self addressed stamped envelopes for returning the questionnaires. Post cards were mailed a week after the initial mailing to serve as a thank you/reminder.

**Results and Discussion**

Among the respondents, 35.7% of the manufacturers represented women's wear firms, 26.2% of the manufacturers represented men's wear firms, and 4.8% of the manufacturers represented children's wear firms. The others category constituted 33.3% of the manufacturers. Most of the firms in the sample employed between 1000 to 4999 workers (43.6%) and had their annual sales volume in the range of $50 to $149M (25%).

## Purchasing Situations for Fabric Materials

The first objective of this study was to determine the types of fabric materials purchasing situations for apparel manufacturers. Table 1 illustrates the question-wise breakdown of the three dimensions of purchasing situations: newness of task, information requirements, and consideration of alternatives. The first three of the seven questions in Table 1 were designed to measure the newness of the purchasing task. The middle two questions were designed to measure the need to gather new information. The last two questions were designed to measure consideration of alternative suppliers and products/fabrics.

**Table 1**
**Question-wise Breakdown for Newness of Task, Information Requirements, and Consideration of Alternatives Dimensions**
Percentage of Respondents Reporting

| ***Questions on Purchasing Situation Dimensions*** | | **Never** | | | | **Always** |
|---|---|---|---|---|---|---|
| | ***(n)*** | **0** | **1** | **2** | **3** | **4** |
| A reorder of previously purchased fabrics | 43 | 9.3 | 62.8 | 25.6 | 2.3 | 0 |
| Orders with same fabric requirements | 43 | 23.3 | 44.2 | 18.6 | 11.6 | 2.3 |
| Orders with different fabric requirements | 40 | 2.5 | 42.5 | 42.5 | 10.0 | 2.5 |
| Complete knowledge of fabric characteristics | 43 | 44.2 | 41.9 | 11.6 | 2.3 | 0 |
| New information requirements | 40 | 0 | 35.0 | 45.0 | 12.5 | 7.5 |
| Consideration of alternative suppliers | 43 | 0 | 46.5 | 44.2 | 9.3 | 0 |
| Consideration of alternative fabrics | 43 | 0 | 30.2 | 41.9 | 20.9 | 7.0 |

A factor analysis was performed to test the dimensionality of the purchasing situation questions relative to the dimensions of: newness of task, information requirements, and consideration of alternatives. Two factors were identified (see Table 2). Factor 1 captured two elements: newness of the task and information requirements. Items representing the third dimension of buyclass (i.e., consideration of alternatives) loaded on Factor 2. Two questions were dropped, because they did not meet the criteria for loading.

Given the multi-dimensionality of the three buyclass characteristics, two measures were developed: (a) measure of newness and information requirements and (b) measure of consideration of alternatives (see Table 3). These findings are contrary to the prediction that the buyclass model has three dimensions (Robinson et al., 1967), but are consistent with the findings of Anderson, Chu, and Weitz (1987), who also found the same two factors to predominate.

Coefficient alpha for Factor 1, newness and information requirements, is .62, an adequate level of reliability for basic research (Nunnally, 1978). The coefficient alpha for Factor 2, consideration of alternatives measure is .41, which indicates only a modest reliability for the measure (see Table 2); however, the factor is consistent in concept with the predicted dimension. Both factors were retained to represent purchasing situation in further analysis.

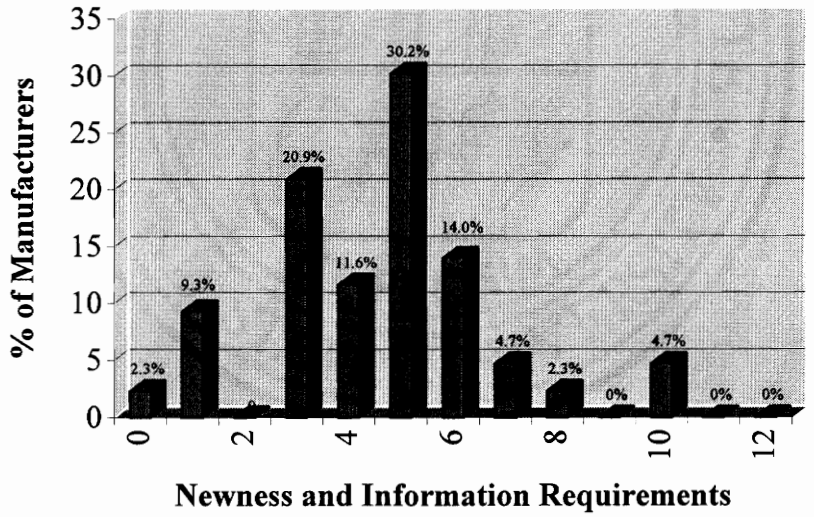
**Table 2**
**Factor Analysis of Purchasing Situation Variable**

| *Factor Analysis* | *Loading* | *Eigenvalue* | *Coefficient alpha* |
|---|---|---|---|
| ***Newness and Information Requirements*** | ***Factor 1*** | 1.13 | .62 |
| Orders with same fabric requirements | 0.67 | | |
| Orders with different fabric requirements | 0.64 | | |
| New information requirements | 0.71 | | |
| ***Consideration of Alternatives*** | ***Factor 2*** | 1.93 | .41 |
| Consideration of alternative suppliers | 0.74 | | |
| Consideration of alternative fabrics | 0.71 | | |

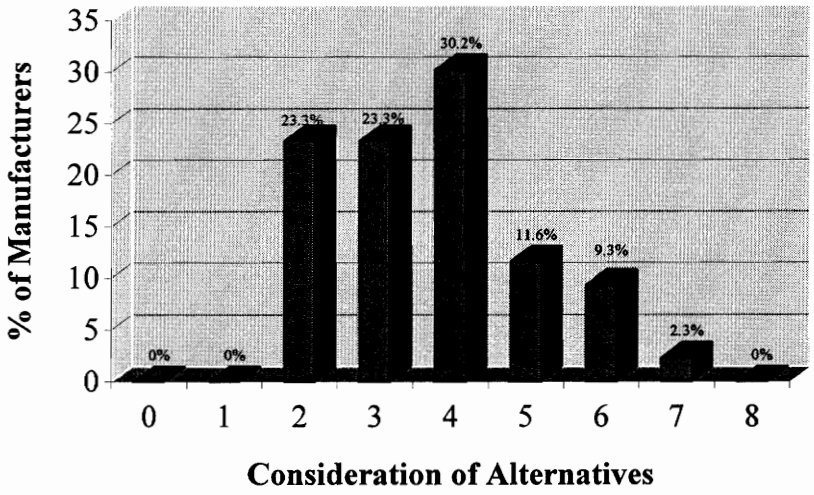
The frequency distribution for types of purchasing situation is shown in Table 3. As indicated in Table 3, 84.4% of the apparel manufacturers had low to moderate scores on the newness and information requirements dimension, indicating their purchasing situations ranged from straight rebuy and moderate rebuy situation. The consideration of alternatives dimension also had low to moderate scores, and 81.3% of the manufacturers were included in the straight rebuy and moderate rebuy situation. These low scores indicate that the respondents chiefly represented the straight rebuy and modified rebuy purchasing situation (see Figures 1 and 2).

**Table 3**
**Types of Purchasing Situations for Fabric Materials for Apparel Manufacturers**
Percentage of Respondents Reporting

| *Purchasing Situations* | **Never** | | | | **Always** |
|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** |
| newness and information requirements | 8.6 | 40.5 | 35.3 | 11.3 | 4.1 |
| consideration of alternatives | 0 | 38.3 | 43.0 | 15.1 | 3.5 |




PURCHASING SITUATION FOR APPAREL MANUFACTURERS
Figure 1




PURCHASING SITUATION FOR APPAREL MANUFACTURERS
Figure 2

## Usage of Computer Technology in Purchasing Process

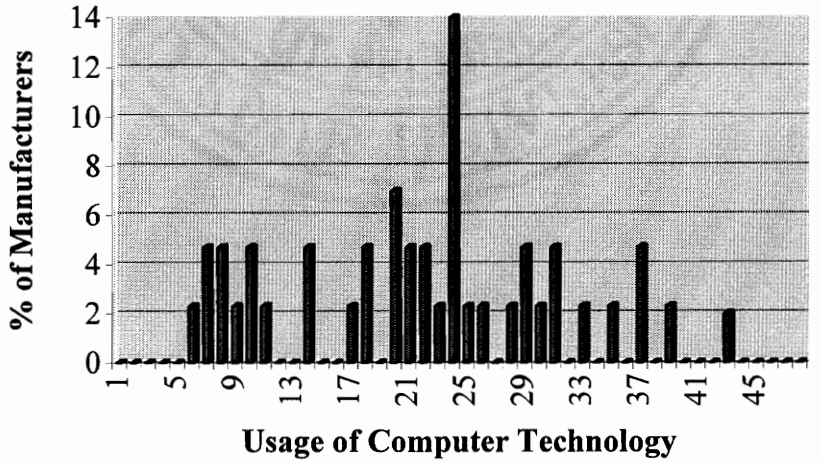
The second objective of the research was to identify the usage of computers in the firm's purchasing process. A list of 12 purchasing activities were developed to measure the usage of computer technology in fabric materials purchasing by apparel manufacturers. The frequency distribution, shown in Table 4, identifies how the usage of computer technology in purchasing differs across the types of purchasing activities being performed.

**Table 4**
**Usage of Computer Technology in Purchasing Activities**
Percentage of Respondents Reporting

| *Purchasing Activities* | | Never | | | | Always |
|---|---|---|---|---|---|---|
| | *(n)* | 0 | 1 | 2 | 3 | 4 |
| Determine quantity | 43 | 7.0 | 7.0 | 11.6 | 30.2 | 44.2 |
| Describe fabric | 42 | 23.8 | 11.9 | 14.3 | 23.8 | 26.2 |
| Search for supplier sources | 43 | 51.2 | 25.6 | 16.3 | 4.7 | 2.3 |
| Request for price quotations | 43 | 58.1 | 14.0 | 18.6 | 7.0 | 2.3 |
| Prepare purchase order | 42 | 9.5 | 4.8 | 9.5 | 21.4 | 54.8 |
| Transmit purchase order | 43 | 53.5 | 14.0 | 2.3 | 11.6 | 18.6 |
| Expedite | 43 | 37.2 | 16.3 | 9.3 | 18.6 | 18.6 |
| Monitor purchase order status | 43 | 7.0 | 9.3 | 16.3 | 27.9 | 39.5 |
| Send invoices | 38 | 42.1 | 0.0 | 15.8 | 18.4 | 23.7 |
| Evaluate buyer performance | 43 | 46.5 | 9.3 | 16.3 | 9.3 | 18.6 |
| Evaluate vendor performance | 43 | 41.9 | 9.3 | 14.0 | 11.6 | 23.3 |
| Record vendor history | 43 | 25.6 | 4.7 | 20.9 | 11.6 | 37.2 |

The most common purchasing activities, for which computer technology was used, were: determining the quantity of needed fabric, preparing purchase order, monitoring purchase order status, and recording vendor history. Those purchasing activities, for which little or no computer technology was used, were: searching for supplier sources, requesting price quotations, transmitting and expediting purchase orders, sending invoices, and evaluating buyer and vendor performances (see Table 4). A finding of this study was that either computer technology was used or not used for specific activities by apparel manufacturers. Few manufacturers reported moderate usage of computer technology on a specific activity.

When seen at the global level, however, the overall usage of computer technology for purchasing process is moderate for apparel manufacturing firms in the sample (see Figure 3). This can be explained because the respondents reported either high or low usage of computer technology for specific purchasing activities, and therefore the overall picture of usage of computer technology emerges as moderate. The variable usage of computer technology was formed by a summation of the scores on all of the specific purchasing activities. The coefficient alpha of .82 was obtained for the usage of computer technology variable, which is a high level of reliability for the measure (Nunnally, 1978). This summation variable was used to represent usage of computer technology in further analysis.




USAGE OF COMPUTER TECHNOLOGY IN PURCHASING PROCESS
Figure 3

**Breadth of Computerization by Purchasing Activity**

Among the manufacturers who were currently on-line, the manufacturers were using computers mainly within the purchasing department (see Table 5). Very few manufacturers were connected via computers to vendors. The main activities, for which the respondents were linked with their vendors via computer network, were quantity determination, fabric description, and monitor of purchase order status.

**Table 5**
**Breadth of Computerization by Purchasing Activity**
Percentage of Respondents Reporting

| *Purchasing Activity* | *Not On-Line* | *Currently On-line* | *Breadth of On-line System* | | |
|---|---|---|---|---|---|
| | | | *Within Purchasing* | *Firm-wide* | *With Vendor* |
| Determine quantity | 9.5 | 90.5 | 76.2 | 38.1 | 14.3 |
| Describe fabric | 22.0 | 78.0 | 51.2 | 46.3 | 19.5 |
| Search for supplier sources | 68.3 | 31.7 | 29.3 | 2.4 | 4.9 |
| Request for price quotations | 57.5 | 42.5 | 35.0 | 5.0 | 7.5 |
| Prepare purchase order | 12.2 | 87.8 | 78.0 | 14.6 | 4.9 |
| Transmit purchase order | 56.1 | 43.9 | 34.1 | 7.3 | 4.9 |
| Expedite | 41.5 | 58.5 | 46.3 | 9.8 | 9.8 |
| Monitor Purchase Order Status | 14.3 | 85.7 | 76.2 | 16.7 | 14.3 |
| Send Invoices | 62.5 | 37.5 | 17.5 | 20.0 | 5.0 |
| Evaluate buyer performance | 61.9 | 38.1 | 33.3 | 4.8 | 2.4 |
| Evaluate vendor performance | 45.2 | 54.8 | 50.0 | 7.1 | 2.4 |
| Record vendor history | 21.4 | 78.6 | 69.0 | 26.2 | 2.4 |

The most commonly used technologies for communicating purchasing activities were phone and telex/fax (see Table 6). Computer to computer linkage between manufacturers and their vendors was negligible. Table 6 summarizes the current methods of communicating purchasing actions. Purchasing activities

of invoice payment and purchase orders were done primarily through mail. Expediting, status reporting, pricing, and determining product availability and delivery dates were communicated predominantly through the use of phone and telex/fax. In addition, respondents reported very low rate for usage of ANSI (28.0%), TALC, or FASLINC standards (32.2%) as shown in Table 7. These findings suggest the need for developing and using standard document formats to enable transmission of inter-company documents by business organizations.

**Table 6**
**Current Methods of Communicating Purchasing Actions**
Percentage of Respondents Reporting

| *Purchasing actions* | *Phone (voice)* | *Telex/ Fax* | *Mail* | *Supplier generated computer print-outs* | *Terminal to computer* | *Computer to computer* |
|---|---|---|---|---|---|---|
| Product Availability/ Delivery Dates | 90.5 | 90.5 | 31.0 | 50.0 | 9.5 | 7.1 |
| Pricing Information | 87.8 | 80.5 | 43.9 | 17.1 | 2.4 | 2.4 |
| Purchase Orders | 66.7 | 83.3 | 69.0 | 16.7 | 11.9 | 7.1 |
| Expediting | 85.7 | 85.7 | 26.2 | 21.4 | 9.5 | 9.5 |
| Status Reporting | 81.0 | 78.6 | 19.0 | 40.0 | 16.7 | 9.5 |
| Invoice Payment | 12.5 | 25.0 | 92.5 | 12.5 | 5.0 | 5.0 |

**Table 7**
**Percentage and Frequency Distribution for ANSI and TALC/FASLINC Standards**

| *Standards* | Never | | | | | | | | | Always |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | 1 | | 2 | | 3 | | 4 | |
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| ANSI | 13 | 52.0 | 1 | 4.0 | 4 | 16.0 | 6 | 24.0 | 1 | 4.0 |
| TALC/FASLINC | 13 | 46.4 | 1 | 3.6 | 5 | 17.9 | 5 | 17.9 | 4 | 14.3 |

## Relationship between Purchasing Situations and Usage of Computer Technology

The third objective of this study was to determine the relationship between types of purchasing situation and the usage of computer technology in the fabric materials purchasing processes. The following hypothesis was developed to test this relationship: Type of purchasing situation for fabric materials is related to the usage of computer technology in the fabric materials purchasing process. Purchasing situation was measured along the dimensions of (a) newness and information requirements and (b) consideration of alternatives. Based on previous studies (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981), it was expected that straight rebuy would be related to high usage of computer technology. Based on the cited trade literature in the apparel industry (DesMarteau, 1995; Gilreath et al., 1995) it was expected

that new buy situations would be related to usage of computer technology in purchasing activities.

Ordinary least squares regression analysis was used to test the relationship. Two regression models with linear and quadratic terms (i.e., newness and information requirements [NEW+INFO] and consideration of alternatives [ALT]) were specified to examine the relationship between purchasing situation and usage of computer technology (USAGE). To measure the relationship between newness and information requirements and usage of computer technology, the following regression model was specified:

$$USAGE_i = \beta_0 + \beta_1*(NEW+INFO)_i + \beta_2*(NEW+INFO)_i^2 + \epsilon_i$$

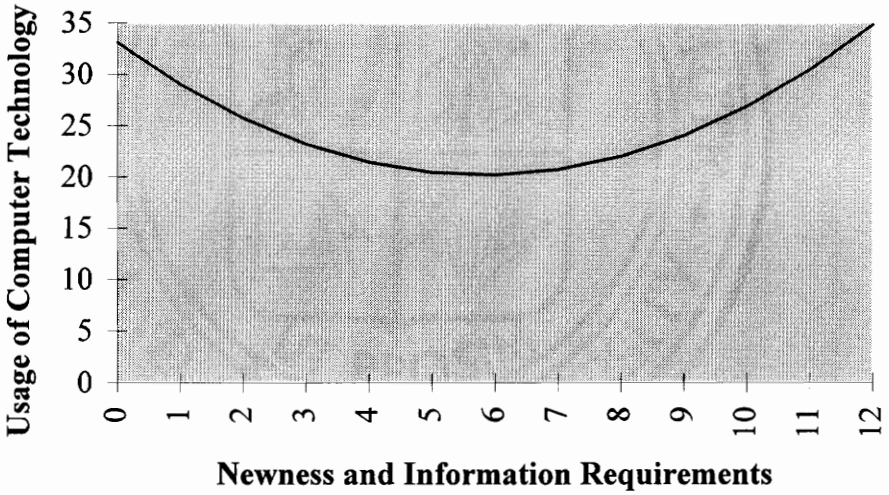
The fitted model obtained was as follows:

$$USAGE = 33.078 - 4.454*(NEW+INFO) + 0.383*(NEW+INFO)^2$$

The *p*-values based on the *t*-statistics for the linear term ($p = 0.041$) and quadratic term ($p = 0.071$) support that newness and information requirements is related to usage of computer technology (see Table 8). The fitted quadratic model indicates a significant bi-polar relationship between newness and information requirements and usage of computer technology (see Figure 4).

**Table 8**
**Results of Regression: Usage of Computer Technology on Newness and Information Requirements**

| *Independent Variable* | *df* | *Regression Coefficient* | *t-value* | *p-value* |
|---|---|---|---|---|
| Intercept | 1 | 33.078 | 6.338 | 0.0001 |
| NEW+INFO | 1 | -4.454 | -2.102 | 0.0419 |
| NEW+INFO $^2$ | 1 | 0.383 | 1.853 | 0.0712 |




RELATIONSHIP BETWEEN USAGE OF COMPUTER TECHNOLOGY AND NEWNESS AND INFORMATION REQUIREMENTS
Figure 4

Additionally, the following regression model was specified to test the relationship between consideration of alternatives (ALT) and usage of computer technology (USAGE):

$$USAGE_i = \beta_0 + \beta_1*(ALT)_i + \beta_2*(ALT)_i^2 + \in_i$$

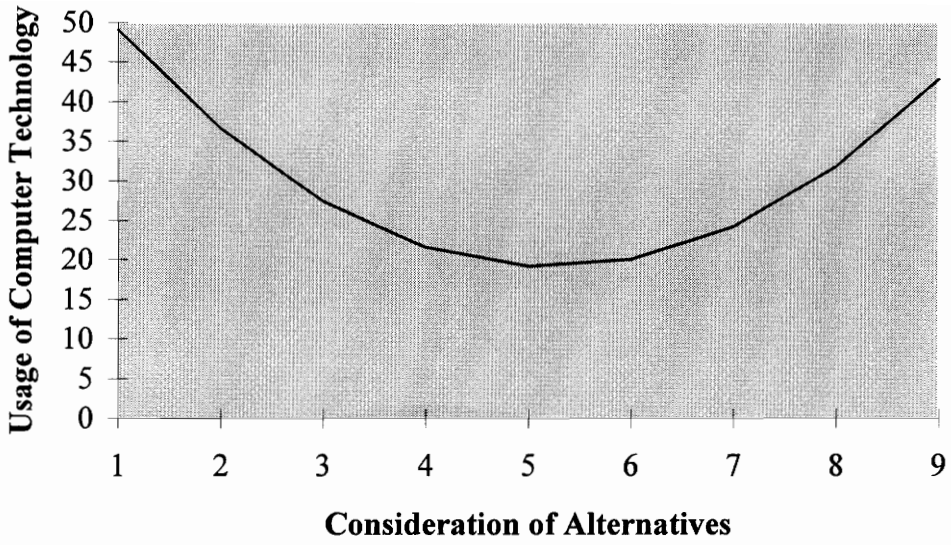
The fitted model obtained was as follows:

$$USAGE = 49.079 - 14.198*(ALT) + 1.676*(ALT)^2$$

The *p*-values based on the *t*-statistics for the linear term ($p = 0.021$) and quadratic term ($p = 0.026$) support that consideration of alternatives is related to usage of computer technology computer (see Table 9). The fitted quadratic model indicates a significant bi-polar relationship between consideration of alternatives, and usage of computer technology (see Figure 5).

**Table 9**
**Results of Regression: Usage of Computer Technology on Consideration of Alternatives**

| *Independent Variable* | *df* | *Regression Coefficient* | *t-value* | *p-value* |
|---|---|---|---|---|
| Intercept | 1 | 49.079 | 4.396 | 0.0001 |
| ALT | 1 | -14.198 | -2.393 | 0.0215 |
| $ALT^2$ | 1 | 1.676 | 2.300 | 0.0267 |




RELATIONSHIP BETWEEN USAGE OF COMPUTER TECHNOLOGY AND CONSIDERATION OF ALTERNATIVES
Figure 5

The results indicate that, when the purchasing situation is represented by either straight rebuy or new buy situation, usage of computer technology in purchasing is high. Hypothesis 1 is supported. This finding is consistent with previous empirical works (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981) that claim computer systems to be particularly useful for highly repetitive buying tasks such as straight rebuys. This finding also adds a new dimension to previous research on usage of computers in purchasing by highlighting the fact that computer systems are also used for new buy situations. These results may be attributed to the unique nature of the

apparel industry which can be contrasted with Original Equipment Manufacturing (OEM) industry and other hard goods industries, the focus of the earlier studies (Carter & Ragatz, 1991; Hutt & Speh, 1992; Mathews et al., 1977; Parasuraman, 1981). The apparel industry, in general, is characterized by both basic, staple products and by seasonal, fashion products (Dickerson, 1991; Glock & Kunz, 1990). The use of computer technology for new buy situations can perhaps be explained, because they facilitate quick response, speedy delivery, and open communication between trading partners for changing products. On the other hand, the use of computer technology for straight rebuy situations can be explained because of automated replenishment of basic goods.

**Implications**

The results of this study provide a foundation for conducting subsequent research on purchasing related issues within the of apparel industry. The typology of purchasing situations developed for large-size apparel manufacturing firms can be tested for applicability to medium and small-size apparel manufacturing firms. The classification of purchasing situations could also be tested from apparel retailers perspective.

**Recommendations for Future Research**

This study focused solely on fabric materials purchasing activities. Future research could encompass all production materials for apparel (i.e., piece-goods and findings), and equipments and maintenance items.

Further research could be done to more closely examine the profile of the textile manufacturers, and the relationship of the textile manufacturers with their suppliers. Trade literature indicates that apparel manufacturers and their suppliers are not computerizing at the same rate as the textile manufacturers and their suppliers. Lack of computer usage in some areas indicate barriers to their adoption. There are cost and time efficiencies associated with computer usage, and apparel manufacturers could be helped by further investigation of barriers.

Future research can be conducted on the effects of usage of computer technology on firms purchasing performance in relation to the cost associated with usage of computer technology. A comparative analysis between the cost and benefits of usage of computer technology in purchasing could be undertaken.

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