

# 기업특성과 Quick Response Technologies의 사용 수준과의 관계 연구

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## A Study of Relationship between Organizational Characteristics and the Usage Level of Quick Response Technologies

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### Abstract

급변하는 국내외의 교역환경 변화에 따라 의류산업에도 새로운 경영 전략 수립이 요구되고 있다. Quick Response(QR)는 의류제품을 생산하는 기업의 경쟁력을 증가시키기 위해 소개된 새로운 경영 전략으로서, 유통 채널 사이에 정보와 상품의 흐름을 효율화시켜 최대의 소비자 만족을 제공한다. 본 연구의 목적은 QR technologies의 사용현황을 밝히고 기업 특성과 QR technologies 사용 수준과의 관계를 조사하였다. 종속변수는 QR technologies의 사용 수준이며, 선별된 독립변수들은 기업크기(firm size), 기업전략(organizational strategy), 제품종류(product category), 패션변화(fashion change), 주기적변화(seasonal change)였다. 조사대상은 미국 전역에서 무작위로 추출된 306 개의 의류업체를 대상으로 하였으며, 1차 우편과 2차 전화로, 설문지를 통해 자료수집을 하였다. 설문 응답률은 47%(n=103)였고, 자료의 분석은 기술통계(i, e., 빈도, 퍼센트)와 비모수 통계기법을 사용하였다.

가장 많이 사용되고 있는 QR technologies는 소량주문(small lot orders), 단기 사이클 재단 계획(short cycle cut planning)과 고객의견이 반영된 생산계획(production planning with customers)이었다. 가장 적게 사용되고 있는 QR technologies는 전자 재주문(electronic reorder)과 단위생산 시스템(unit production system)이었다. QR technologies 사용수준에 관계가 있는 것은 기업크기(firm size), 기업전략(organizational strategy), 패션변화(fashion change)임으로 나타났다. 의류업체의 크기가 클수록, 혁신적 선도기업일수록, 패션변화가 큰 제품을 취급할수록 QR technologies의 사용수준이 높은 것으로 나타났다. 의류업체는 자원과 생산하는 제품종류에 따라 경영전략과 QR technologies의 사용수준이 다양하였다.

## I. INTRODUCTION

Environmental changes (e.g., threat of imports) have increased the difficulties in operating an apparel business. To manage the environmental forces, Quick Response (QR), as an appropriate strategy for the apparel industry, has been used. QR is defined as a new business strategy to optimize the flow of information and merchandise between channel members in order to maximize consumer satisfaction (Voluntary Interindustry Communication Standards, 1989). Although QR is perceived as a profitable strategy, QR has been adopted by only 40% of the apparel manufacturers (KSA, 1992). For increased QR adoption, the variables influencing QR adoption should be known.

The purpose of this study was to identify the usage of QR technologies and to examine associations between organizational characteristics and the usage level of QR technologies in the apparel industry. Using the usage level of QR technologies as the dependent variable, the selected independent variables were: firm size (i.e., numbers of employees, dollar amounts of sales volume), organizational strategy (i.e., prospector, analyzer, reactor, defender), and product characteristics (i.e., product category, fashion change, seasonal change).

## II. BACKGROUND

### 1. Environmental Management Theory

Environmental management theories explain that firms can manage environmental changes by modifying existing environments. One of the most popular classifications of the environmental management strategies is the Miles and Snow typology (Zahra & Pearce II, 1990). Miles and Snow's typology (1978) is based on strategic choices concerning major managerial problems. This typology is useful when analyzing the ways in which firms

interact with their environment and the subsequent business strategies they adopt. This typology is a relatively complex strategic typology that is inter-related with organizational strategy, structure, and process variables (Conant, Mokwa & Varadarajan, 1990). The Miles and Snow typology views the organization as a complete and integrated system in dynamic interaction with its environment (McDaniel & Kolari, 1987). To examine the relationship between environment and organization, Miles and Snow's strategic typology as an environmental management strategy is used in this study.

Miles and Snow (1978) identified behavior patterns of competing firms within an industry as four organizational strategic types: (1) prospectors, (2) defenders, (3) analyzers, and (4) reactors. Prospectors attempt to pioneer in product/market development and are also described as creators of change and uncertainty to which competitors must respond. Defenders engage in little or no new product/market development. Often, they control secure niches within their industries, competing primarily on the basis of price, quality, delivery, or service. Analyzers are an intermediate type. They make fewer and slower product/market changes than do prospectors, and they are less committed to stability and efficiency than are defenders. Reactors lack a consistent strategy and only respond to environmental pressures.

### 2. Need for QR

Product change and import competition have created a major need for new strategies such as QR. Fashion and seasonal changes happen frequently in apparel; therefore, flexibility in production is required. Frequent changes increase the cost of production unless steps are taken to minimize the impact of these changes. Hunter (1990) explained that increases in the rate of product change mean shorter runs and more styles in process at one time.

This problem can be solved by using a set of QR technologies (i.e., unit production system [UPS], short cycle production, bar coding, and inventory reduction) (AAMA, 1987; Hunter, 1990). QR also offers retailers the advantage of fashion predictions closer to consumer purchasing of goods (AAMA, 1987; KSA, 1992; Tyler, 1991).

Currently imports are a major share of the American apparel market. The ratio of imports penetration in the U.S. was from 2.1% in 1961 to 26.2% in 1990 (U.S. Bureau of the Census, 1991). The U.S. deficit for apparel was over \$20 billion in 1989 (U.S. Bureau of the Census, 1990). To survive in the threatening environment by imports, domestic manufacturers need a new business strategy to offer better services to retailers. The use of bar coding at point of sale is one example of how QR reduces the incidence of stock-outs and improves customer service. Pilot studies have shown that the ability to replenish merchandise in a short reorder time can reduce retailer initial inventory investment for a season and can increase sales by providing the stock needed throughout the season (AAMA, 1987). Most of all, QR offers retailers attractive alternatives to the purchase of imports.

### 3. QR Technologies

To accomplish the objectives of QR, firms must use a variety of technologies (VICS, 1989). Technology was defined as "the physical combined with the intellectual or knowledge processes by which materials in some form are transformed into outputs used by another organization or subsystem within the same organization" (Hulin & Roznowski, 1985, p. 47). A variety of technologies related to QR have been identified from numbers of industry sources (Andersen Consulting Company, 1991; Ernst & Whinney, 1990; Gillease, 1988; Hunter, 1990; KSA, 1992; Little, 1988, 1990) and research studies (Kincade, 1989; Sullivan, 1990). The most commonly mentioned seventeen technologies are: (1) com-

puter-aided design (CAD), (2) computer-aided pattern making, (3) shade sorting, (4) product planning with customers, (5) computer-aided manufacturing, (6) unit production system (UPS), (7) automated sewing operations, (8) short cycle cutting planning, (9) short cycle sewing, (10) computerized inventory systems, (11) reduction in inventory size, (12) small lot orders, (13) bar coding, (14) scanning of fabric rolls, (15) electronic reorder, (16) sharing product information with trading partners, and (17) receiving point-of-sale (POS) data.

### III. CONCEPTUAL FRAMEWORK

The conceptual framework for this study was based on Rogers' adoption theory (1983). Adoption is a decision to make full use of an innovation as the best course of action available. Rejection is a decision not to adopt an innovation. Adoption occurs at the decision stage in the innovation-decision process. For this study, a factor approach was used to examine a cross-section of firms in order to determine significant characteristics influencing the usage level of QR technologies. This study emphasized organizational characteristics: firm size, organizational strategy, and product characteristics.

Firm size has been shown to influence the adoption of innovations in several industries (Ettlie et al., 1984; Mansfield, 1968, 1983; Rogers, 1983). In the apparel industry, firm size varies from very small firms (1-9 employees) to large firms (over 500 employees). Kincade (1989) and Sullivan (1990) found a significant positive relationships between size of firm and QR adoption in the apparel industry.

Organizational strategy was related to innovation adoption in other industries (Duchesneau, Cohn, & Dutton, 1979; Ettlie, et al., 1984). Organizational strategy has been shown to be affected by organizational structure (Ettlie et al.,

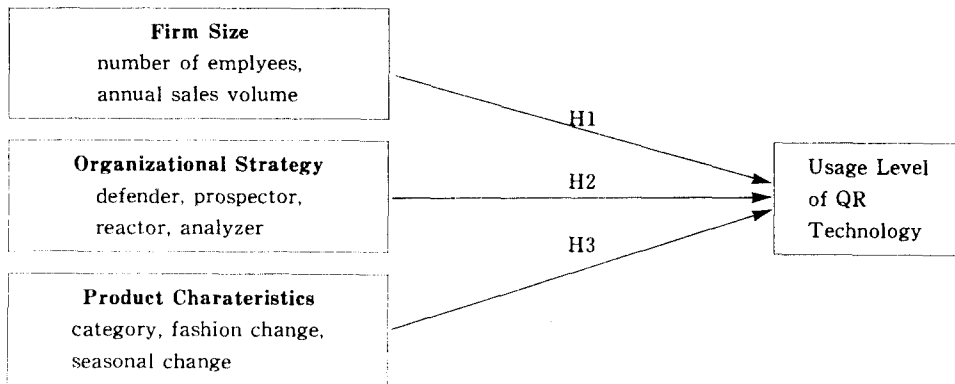


Fig. 1. Hypothesized Relationships

1984). Organizational structure has also been studied as an important factor to adoption innovation (Emmelhainz, 1988; Gatignon & Robertson, 1989) and new product introduction (Ettlie, 1983). Organizational strategy has been hypothesized to influence the adoption decision (Damanpour, 1987; Ettlie, 1983; Ettlie et al., 1984).

Product characteristics were found to be related to innovation adoption in the apparel industry (Mansfield et al., 1971). Different product categories (women's, men's, children's / infants' wear) vary in their attributes such as product life cycle or scale of production. Men's and children's / infants' wear are generally less subject to change from year to year and are more suitable to large scale production. Seasonal and fashionable goods are more difficult to predict because of the change (Glock & Kunz, 1990; Office of Technology Assessment, 1987). Men's wear firms were more likely to adopt QR because of standardization of style and slower fashion turn (Technical Advisory Committee of AAMA, 1987).

The purpose of this study was to identify the usage of QR technologies and to examine associations between organizational characteristics (i.e., firm size, organizational strategy, product characteristics) and the usage level of QR technologies in the apparel industry. Fig. 1 shows hypothesized relationships between variables. Three research

hypotheses were formulated.

- H 1. The firm size (i.e., number of employees, the dollar amounts of annual sales) is positively associated with the usage level of QR technologies.
- H 2. The organizational strategy of the firm (i.e., prospector, analyzer, reactor, defender) is associated with the usage level of QR technologies.
- H 3. The product characteristics of the firm (i.e., product category, fashion change, seasonal change) are associated with the usage level of QR technologies.

#### IV. RESEARCH METHOD

##### 1. Sampling

A stratified random sample of 306 apparel manufacturers without locational limitation were selected from a list purchased from the Polk Co. The sample was stratified by firm size (i.e., number of employees) and product category (i.e., men's, women's, children / infant's wear). Equal numbers of apparel manufacturers were selected from each stratum. The total design method by Dillman (1978) was adapted for data collection in January, 1993. A mail questionnaire was pilot tested for content

validity and instrument reliability, and the revised questionnaire was used to survey plant managers. A thank you/reminder postcard was mailed one week after the initial mailing. Follow-up phone calls were made to increase response rate and to investigate the reason for nonresponse.

## 2. Instrument

An instrument was developed to measure the major constructs for the study. **The usage level of QR technologies** was measured by the reported usage of 17 QR technologies. For each item, the respondent was asked to circle the usage level of technologies on a scale from 0 (not at all) to 5 (very much). The **firm size** variable was measured by the number of employees and the dollar amounts of annual sales. Firm size by number of employees was divided into six groups: 1-9, 10-19, 20-49, 50-99, 100-499, and over 500 employees. Firm size by dollar amounts of annual sales volume was divided into seven groups: under \$0.1 million (M), \$0.1-0.49M, \$0.5-0.99M, \$1.0-4.99M, \$5.0-9.9M, \$10-49M, and over \$50M.

For the **organizational strategy**, a self-reporting approach, including the four dimensions about entrepreneurial problems and solutions, was adapted to determine strategic type. The four dimensions were (1) product market domain, (2) surveillance, (3) growth, and (4) success posture (Conant et al., 1989). Respondents were asked to answer each question by circling one of the four response options which they perceived best characterized their organization. Each response option represented a strategic type. Organizational strategy was identified based on the response option that was selected most often.

**Product characteristics** included product category, fashion change and seasonal change. The product category was divided into three groups: men's, women's, and children's/infants' wear adapted from the SIC codes (Solinger, 1988). A

fourth 'others' category was added into the questionnaire to cover all possible answers such as sportswear and unisex wear (Kincade, 1989; Sullivan, 1990). Many apparel firms produce several different product categories. Firms were instructed to select only the major category, as defined in terms of the highest annual sales volume. Fashion change and seasonal change as product characteristics were developed from Glock and Kunz (1990). Measurement of fashion change was determined by the selection of a fashion change type: highly fashionable, fashionable, fashionable and basic, and basic. Seasonal change was determined by the selection of a product demand time: at special times (highly seasonal), seasonally (seasonal), occasionally (seasonal and staple), and regularly (staple). The terms in parentheses did not appear on the questionnaire. These terms represent the meaning intended by the researcher and confirmed by the pilot study.

## 3. Data Analysis

For the data analysis in this study, descriptive statistics (i.e., frequency, percent) were used to identify the usage of QR technologies and nonparametric statistics (i.e., Kruskal-Wallis test, Wilcoxon Sign test by rank sums) were used to examine the associations between organizational characteristics and the usage level of QR technologies. Statistical significance level was set at 0.05.

# V. FINDINGS AND DISCUSSION

## 1. Profile of Respondent Companies

The adjusted response rate was 47.0% for 103 usable responses based on the adjusted sample (n=219). Profile of respondent companies was made by firm size and product category (see Table 1). All sizes of apparel manufacturers were included in the study. The most common firm size were over 500

**Table 1.** Number of Questionnaire Responds Profiled by Number of Employees and Product Category

Firm size	Product Category					
	Women	Men	Children	Others	Total	%
1-9	7	3	2	0	12	11.76
10-19	0	3	5	2	10	9.80
20-49	2	3	6	1	12	11.76
50-99	8	4	7	2	21	20.59
100-499	8	3	10	2	23	22.55
500+	11	8	3	2	24	23.53
Total	36	24	33	9	102	100.00
%	35.29	23.53	32.35	8.82	100.00	

employees, 100-499 employees, and 50-99 employees. The most common group only by annual sales volume were \$1M and over \$50M.

The three product categories (i.e., women's, men's, children's/infants' wear) were equally represented. According to fashion change, the most common group was combined fashionable and basic goods. In seasonal change, staple goods was the largest group, and the second group was seasonal goods. In terms of Miles and Snow strategic typology (1978), the most common strategic type was prospector, and the second most common was defender.

The usage level of QR technologies varied by apparel manufacturers. The most frequently used technologies were small lot orders, short cycle cut planning, short cycle sewing, and production planning with customer. The least used QR technologies were electronic reorder, shade sorting, and UPS.

## 2. Test of Hypotheses

To examine the relationships between each firm characteristic and usage level of QR technologies and to explore the variations of levels within each variable, additional statistical analyses were done. For testing of Hypotheses 1, 2, 3, Kruskal-Wallis test was employed. The association between firm

size (i.e., number of employees, dollar amounts of annual sales volume) and usage level of QR technologies was significant from Kruskal-Wallis test (for the number of employees,  $\chi^2[5, n=76]=23.85, p<.01$ , for the dollar amounts of annual sales volume,  $\chi^2[6, n=63]=22.61, p<.01$ ). Wilcoxon Scores by rank sums of the usage level of QR technologies were examined for differences between the levels of firm size (see Fig. 2). For firm size by number of employees, the larger firm with many employees were found to have the higher usage level of QR technologies. Firms with over 500 employees had the highest mean scores ( $m=58.00$ ) while firms with 10-19 employees had the lowest mean scores ( $m=21.44$ ).

For firm size by dollar amounts of annual sales volume, the firm with higher sales volume had higher usage level of QR technologies and was more likely to adopt QR. Firms with sales volume of \$50 M had the highest mean scores ( $m=51.55$ ) while firms with sales volume of under \$0.1 M had the lowest means scores ( $m=17.00$ ). The results of this study were consistent with previous studies (Kincade, 1989; Sullivan, 1990), which showed that a strong positive relationship exists between firm size and QR adoption.

Association between organizational strategy and the usage level of QR technologies was significant

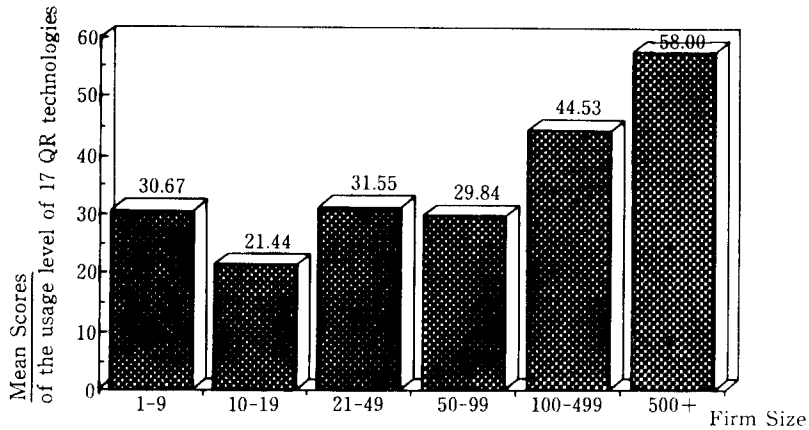


Fig. 2. Mean Scores of the Usage Level of QR Technologies by Firm Size

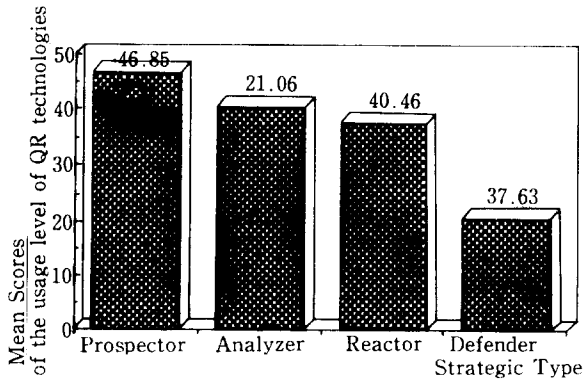


Fig. 3. Mean Scores of the Usage Level of QR Technologies by Organizational Strategy

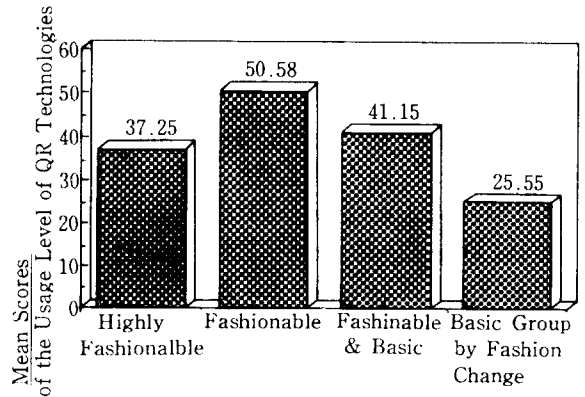


Fig. 4. Mean Scores of the Usage Level of QR Technologies by Fashion Change

from Kruskal-Wallis test ( $\chi^2[5, n=74]=15.91, p<.01$ ). Wilcoxon Scores by rank sums of the usage level of QR technologies were examined for differences between organizational strategies (see Fig. 3). Prospectors had the highest mean scores for the usage level of QR technologies ( $m=46.85$ ). This result was expected, because the characteristics of prospectors are to pioneer in product development and market demand. QR could enable prospectors to pursue their missions and to address environmental change. This result is consistent with the previous studies and supports the Miles and Snow typology (1978) and Rogers' adoption theory (1983).

In the product characteristics, only fashion change was significant with the usage level of QR technologies ( $\chi^2[3, n=77]=12.04, p<.01$ ), but other two characteristics (i.e., product category and seasonal change) were not significant. Wilcoxon scores by rank sums of the usage level of QR technologies were examined for the differences between the groups by fashion change (see Fig. 4). Fashionable goods had the highest mean scores for the usage level of QR technologies ( $m=50.58$ ) while basic goods had the lowest scores ( $m=25.55$ ). Fashion change was an important factor in determining firm's reaction to the environment in the apparel

industry such as usage of technologies (Glock & Kunz, 1990; Hunter, 1990).

## VI. CONCLUSION

To be competitive in the business environment, QR has been offered as a new business strategy for the apparel industry. When a firm adopts QR as an innovation, the knowledge of QR and its technologies are critical to help strategic planning and evaluation of QR. This study has several conclusions.

Firm size and organizational strategy were significantly associated with the usage level of QR technologies. The larger firms and firms classified as prospectors had the higher usage level of QR technologies. Larger firms may be able to invest in the technology than smaller ones, and the innovative characteristics of prospectors are suitable for QR adoption.

One fifth of respondents were reactors. By definition, reactors do not have a consistent strategy to react to the external environment. To assist these manufacturers in the business environment, a consistent strategy may be developed through training programs.

Variables for seasonal change did not have significant association with the usage level of QR technologies. The seasonal change is often confused with fashion change among the apparel manufacturers (Glock & Kunz, 1990). Although measurement of these constructs were tested in the pilot study, apparel manufacturers may not clearly understand the differences between these two variables.

The usage of QR technologies varies by firms with different organizational characteristics. Knowledge of QR technology usage can be used by consultants to select better combinations of QR usage for each of apparel manufacturers. This information will help apparel manufacturers and

retailers to do strategic planning and to evaluate the adoption of QR technologies.

## VII. SUGGESTIONS

Further research areas are recommended from the results of this study. The three variables (i.e., firm size, organizational strategy, and product characteristics) were examined to determine QR adoption in this study. Other variables may be selected from Rogers' adoption theory (1983) for use in further research (i.e., attributes of QR, organizational structure, performance, communication channels, and other external influences).

Product category was identified as women's, men's, children's/infants wear, and others in this study, but this category is too broad since different clothing styles may need different technologies in production and its planning. Further study is needed to narrow the product category according to the style such as shirts, skirts, and pants. This narrow product category may increase the controllability of the experimental design.

Fashion change is determined by changes in style of garment which is accepted by a large segment of people at a certain time. Seasonal change is determined by a combination of factors related to the calendar year including weather changes and seasonal events. Apparel manufacturers and academics often confused these two terms (Glock & Kunz, 1990). Further research is needed to test the correlation between fashion change and seasonal change.

QR was examined from the perspective of apparel manufacturers. Future research is needed to investigate the perspective of retailers and textile producers because trading partners in the apparel complex are related. Specifically, identification of technologies used in retail stores and textile mills is needed for better channel service.



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