

## A Study on the Relationship between Company Performance and Production Management in Apparel Manufacture

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### Abstract

*The purposes of this study were 1) to investigate usage level of production strategies based on group of production environment, 2) to investigate usage level of production systems based on group of production strategy, and 3) to analyze each of company performance based on group of production strategy and system. For this study, the questionnaires were administered to 215 apparel manufacturers in metropolitan area from Feb. to Mar. 1998. Employing a sample of 201, data were analyzed by factor analysis, descriptive statistics, cluster analysis, discriminant analysis, and multivariate analysis of variance.*

*The following are the results of this study.*

1. *Concerning production strategy due to group of production environment, the stable group and the complicated group prefer to price/quality centered strategy but the level of usage for strategies is so pretty that it is not significant to carry out them.*
2. *Concerning production system due to group of production strategy, the workers centered group is occupied high in the price/quality centered group & the complex group. And also the product centered system is occupied high in the flexibility centered group.*
3. *Concerning company performance due to group of production strategy and system, the price/quality centered group holds low position of performance comparing to another groups. And the performance of the managers centered group is higher than that of the workers.*

*Key words : production environment, production strategy, production system, apparel manufacture.*

### I. Introduction

Across the industries, the markets become more and more competitive to meet ever-diversifying consumers' needs. The market for apparel manufacturers is not an exception. So far, Korea's apparel manufacturers have grown by combining the favorable OEM(Original Equipment Manufacturing) mode with their productive but cheaper labor and thereby, sharpening their

price-competitive edge. Such a production model enjoys a comparative advantage, because it can make use of the mass production system and allows for uninterrupted supply subcontracts. However, as the demands from markets have been more and more diversified with the pressure for higher wage increasing in the labor markets, our apparel manufacturing companies are requested to manage the production more efficiently and thereby, adapt themselves to the changing business environment.

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Like other academic turfs, production management needs to change according as the social environment changes, because it can no longer develop if it ignores the changing environment. It is essential for any manufacturing company to research into its production strategies and systems. In Korea, production management began to be studied on a full scale since 1990's, mostly by large electronic and machine manufacturing companies. Namely, it has drawn little attention from small and medium manufacturers, much less from apparel manufacturers.

Traditionally, production managers wanted to maximize the performance of production in terms of ratio of input to output, or production efficiency, but recently, they began to pay attention to the production performance from a viewpoint of production strategy. In other words, it is now essential to evaluate how successfully a company has performed in light of its well-defined objective (or a strategic goal), and therefore, the objective of production department lies in not efficiency but effectiveness<sup>1)</sup>.

Lee, Kyong-Hwan<sup>2)</sup> argued that the economic performances (average ratio of profits to sales, average ratio of sales increase, average ratio of earning to investment, etc.) of a production system may differ depending on compatibility between competition and production strategies.

Traditionally, companies have focused their business performance on their financial performance, namely cost and price competition. However, as the world markets become more and more competitive, world-class companies tend to provide their customers with best-quality goods and services at a minimum price level. Such a changing market environment requires our managers to evaluate their business performances in reference to not only the conventional financial indices but also non-financial ones<sup>3)</sup>. The financial indices involve the capability of producing commodities at a lower cost, while the non-financial ones reflect the capacity to meet consumers' needs other than lower price. The examples of the latter indices may be quality, delivery, market share, competitiveness and factory operation ratio, all of which are deemed more and more important for business strategies.

In Korea, the research into the production management for apparel manufacturers seems to be still at its infant stage. The rare examples are those studies on balanced production management for productivity and efficiency<sup>4,5)</sup> and on standard production time calculated at the production line<sup>6,7)</sup>, and on automation of apparel production line<sup>8,9)</sup>, and on conditions of the production systems<sup>10)</sup>. Unfortunately, however,

<sup>1</sup> P. R. Richardson, A. J. Taylor and J. R. M. Gorden, A Strategic Approach to Evaluating Manufacturing Performance. *Interface*, 15(6): (1985). 15-27.

<sup>2</sup> K. H. Lee, 1990. A Study on Manufacturing Strategy for Competitive Advantages. (Ph. D. diss., Seoul National University).

<sup>3</sup> Song Ja and I. Y. Kim, *A Reality of High production Technology and Management Account*. (The Chamber of Commerce. 1989).

<sup>4</sup> B. S. Park, A Technical Guidance due to Actual Proof for Productivity Improvement of Apparel Manufacturing. (Kookmin Univ. Ph.D. 1989).

<sup>5</sup> Ho-Hyun Jo, A Study on the Line Balancing for Productivity Improvement of Knit Shirts's Manufacturing Process. (Inha University. Ph.D. 1994).

<sup>6</sup> Ministry of Trade and Sewing Science Research Institute. *Manufacturing Technical Standard Book of Clothing & Textiles Products*. 1995.

<sup>7</sup> Ok-Kyung Kim, A Study on the Method and Work Measurement for Productivity Improvement of Clothing Products - Centering MTM Analysis -. (Ph.D. diss., Sungshin Women's University. 1998).

<sup>8</sup> Jeong-Wook Choi, A Study on the Usage of Apparel CAD Systems. (Ewha Women's University. Master's thesis, 1993).

there has been no study on production strategies and systems for apparel manufacturers.

Given such conditions, the study aims to review the production strategies and systems in apparel manufacture and thereby, determine the relationship between production management variables and company performance. To this end, the following three-fold research points are set up; First, differences of production strategies will be examined depending on group of production environment; Second, differences of production systems will be analyzed depending on group of production strategy; Third, the effects of production strategy group and system group on company performances will be analyzed. It is expected that this study will contribute to development of production management theories for domestic apparel manufacturers by providing for the data useful to designing of effective production strategies and choosing of efficient production systems.

## II. Research Method

### 1. Research Problem

- 1) Will the production strategies of apparel manufacturers differ depending on group of production environment?
- 2) Will the production systems of apparel manufacturers differ depending on group of production strategy?
- 3) Will the company performances of apparel manufactures differ depending on group of production strategy and system?

### 2. Terminology

#### 1) Production Environment

This means the environment related directly with production. It is associated with complexity of product environment, uncertainty of demand

/supply environment and uncertainty of worker environment;

- Complexity of product environment: This means the complexity in terms of number of processes, number of products, number of workplaces, frequency of using new materials, etc.
- Uncertainty of demand/supply environment: This means the uncertainty in the lights of prediction of market demands, decrease of market demands, delivery of raw/subsidiary materials, quality of raw/subsidiary materials, etc.
- Uncertainty of worker environment: This means the uncertainty in view of shift of technical manpower and management of workers.

#### 2) Production Strategy

This implies unique advantages to pursue a competitive edge in production. Its variables adopted in this study are price, quality, delivery and flexibility. Production strategy may be further divided into flexibility centered strategy, delivery centered strategy and price/quality centered strategy, depending on the influence of its variables.

- Flexibility centered strategy: This sub-strategy focuses on the capacities to respond to changing designs, a variety of small orders, changes of production quantity or customers' diversifying needs.
- Delivery centered strategy: This sub-strategy pursues a quick and exact delivery.
- Price/quality centered strategy: This sub-strategy focuses on the capacity to manufacture high- or uniform-quality products at a lower cost.

#### 3) Production System

The structure of process through which a

<sup>9</sup> G. A. Park, A Study on the Production Planning and Measurement for Automated Clothing Manufacture. (Ewha Woman's University, Master's thesis, 1996).

<sup>10</sup> M. K. Uh, A Study on the Reinforcement of the Apparel and Needlework. Business in Korea -Focused on their Production Systems-. (Sookmyung Women's University, Master's thesis, 1997)

product is manufactured. The production system comprises three factors such as process management, product process and worker's role. The production system can be recognized of management centered system, product centered system and worker centered system based on usage level of three factors.

- Management centered system: Manufacturing structure which operate in the higher level of systematization and control of process
- Product centered system: Manufacturing structure which operate in the higher level of style change
- Worker centered system: Manufacturing structure which operate in the higher level of process numbers of worker

#### 4) Production Performance

This means the performance of a company in terms of production efficiency. It can be evaluated in light of relative market share, competitiveness of major product, rate of on-time delivery, factory operation ratio, etc.

- Relative market share: A ratio of company's sales to the best market leader in the same type of business
- Competitiveness of major product: A ratio of company's competitiveness to the best competitive market leader in the same type of business
- Rate of on-time delivery: A ratio of company's on-time delivery
- Factory operation ratio: A ratio of actual operating time to the full operation time

#### 5) Group of Production Environment

Domestic apparel manufacturers' production environments can be categorized into stable group, uncertain group and complicated group depending on their production environments;

- Stable group: This group show their dominant production environment factors little. Since they are mostly affected by the uncertainty of demand/supply environment, their production environment may well be

relatively stable.

- Uncertain group: This group of manufacturers tend to be affected by uncertainty of worker environment, uncertainty of demand/supply environment and complexity of product environment, but their product environment is less complex than other groups'.
- Complicated group: This group is affected dominantly by complexity of product environment.

#### 6) Group of Production Strategy

Domestic apparel manufacturing companies can be categorized into the following groups depending on their production strategies;

- Delivery centered group: A group which is dominated by delivery centered strategy.
- Price/quality centered group: A group which is dominated by price/quality centered strategy.
- Flexibility centered group: A group which is dominated by flexibility centered strategy.
- Complex group: A group which is dominated by all production strategies.

#### 7) Group of Production System

Domestic apparel manufactures can also be categorized into following groups depending on their production systems.

- Managers centered group: The production system is controlled dominantly by managers.
- Workers centered group: The production system is operated per product and process.

### 3. Research Method

The 215 factories were randomly survey among the apparel manufacturers for domestic distribution located in Seoul and Kyung-gi region. A questionnaire was pilot tested for content validity and instrument reliability, and the revised questionnaire was used to survey plant managers. The survey was done from 2/21/1998 to 3/14/1998. The president and/or

&lt;Table 1&gt; Profile of Respondent Companies

(Total=201)

Section		N(%)
Product line	Men's wear	18( 9.0)
	Women's wear	127( 63.2)
	Casual wear	26( 12.9)
	Knit wear	28( 13.9)
	Did not answer	2( 1.0)
Number of employees	5 to 19	66( 32.8)
	20 to 49	107( 53.2)
	50 to 99	19( 9.5)
	100 to 299	8( 4.0)
	Did not answer	1( .5)
Number of Items	1	74( 37.2)
	2	27( 13.4)
	3	24( 11.9)
	4	28( 13.9)
	5	21( 10.4)
	6	12( 6.0)
	7 over	14( 7.0)
	Did not answer	1( .5)
Types of firm	Planning & production	45( 22.5)
	Production only	153( 76.1)
	the others	3( 1.5)
Production volume of style	under 99 pieces	20( 10.0)
	100 to 199 pieces	49( 24.4)
	200 to 299 pieces	34( 16.9)
	300 to 499 pieces	43( 21.3)
	500 pieces over	41( 20.4)
	Did not answer	14( 7.0)
'97 Sales volume(won)	under 5M	54( 26.9)
	5.1M to 10 M	53( 26.4)
	10.1M to 30 M	24( 11.9)
	30.1M to 50 M	9( 4.5)
	50.1 M over	7( 3.5)
	Did not answer	54( 26.9)

supervisors were interviewed on the spot and the results were recorded in the form of questionnaires. Discarding the incomplete questionnaires (14 sheets), the data from the other complete questionnaires (201 sheets) was statistically processed and then analyzed.

The <Table 1> shows the profile of the inte

rviewed companies.

#### 4. Instruments

##### 1) Production Environment

Since preceding studies set the production environment in the dimensions of uncertainty

and complexity, the researcher adapted to this study Lee, Kyong-Hwan's<sup>11)</sup> scales including uncertainty and complexity of production environment. The questionnaire consisted of 10 items in total, each of which was scaled based on Likert's five points. (point 1: Never; point 5: Very much so)

### 2) Production Strategy

Since the production strategies were handled by preceding studies in a multi-faceted way, the researcher adapted to this study Lee, Kyong-Hwan's<sup>12)</sup> scale which consisted of such factors as cost, quality, delivery time and flexibility-The factor of service which was not deemed fitting our apparel manufacturing industry was excluded. The final questionnaire consisted of 9 items in total, each of which was scaled based on Likert's five points.

### 3) Production System

The questionnaire is composed of 16 questions which comprise the two distinct groups of questions such as questions about the production system and the characteristics of the manufacturers. Because the production system, as can be known from the existing research, is mainly composed of product and process, most of the questions in the questionnaire are appropriated from Lin's research<sup>13)</sup> and modified to fit the current status of apparel industry in Korea. Three questions about characteristics of a product, two questions about production process

and five questions about systematization of process were measured by Likert measures.

### 4) Production Performance

This study used such variables evaluating production performance as relative market share, competitiveness of major product, ratio of on-time delivery and factory operation ratio. The results of their reliability test are shown in <Table 2>. Since Chronbach's  $\alpha$  coefficient was .6107 exceeding far 0.5, their reliability was not doubted.

### 5. Analysis

Data were analyzed by using factor analysis, descriptive statistics, cluster analysis, discriminant analysis, and multivariate analysis of variance.

## III. Results and Discussions

### 1. Relationship Between Group of Production Environment and Strategies

In order to test the relationship between group of production environment and strategies, multi-variate analysis was conducted. The results of this analysis are shown in <Table 3>. As a result, it was found that production strategies did not differ significantly among production environment groups, which suggests that their production strategies may not be distinguishable.

When the performance level of production strategy factors was reviewed as per production

<Table 2> Reliability of Production Performance

	Mean	S.D	Chronbach's $\alpha$
Performance	13.6508	3.0934	.6107

<sup>11</sup> K. H. Lee, A Study on Manufacturing Strategy for Competitive Advantages. (Ph. D. diss., Seoul National University.1990).

<sup>12</sup> K. H. Lee, A Study on Manufacturing Strategy for Competitive Advantages. (Ph. D. diss., Seoul National University 1990).

<sup>13</sup> S. H. Lin., D. H. Kincaide and C. Warfield, An Analysis of Sewing Systems with a Focus on Alabama Apparel Producers. *Clothing and Textiles Research Journal*, 13 (1): (1995) 30-36.

**<Table 3>** Relationship between Group of Production Environment and Strategies

	Flexibility centered strategy	Delivery centered strategy	Price/quality centered strategy	Hotelling's T <sup>2</sup>
Stable group	.1004	-.1331	.8300	.3024
Uncertain group	-.2506	-.1134	-.1190	.0685
Complicated group	.1859	.2245	.6100	.1162

\*p<.05, \*\*p<.01, \*\*\*p<.001.

environment group, it was found that the strategy performed most efficiently by the stable group was price/quality centered strategy, followed by flexibility and delivery centered strategies. The strategy performed most efficiently by the uncertain group was found to be delivery centered strategy, followed by price/quality and flexibility centered strategies. But the uncertain group's performance level of these two strategies was poorer than the other groups. On the other hand, the strategy performed best by the complex group was price/quality centered strategy, followed by delivery and flexibility centered strategies. This groups showed the best performance level of all three strategies in absolute terms.

As discussed above, the stable group tended to perform their price/quality centered strategy focused on competitive price, high and uniform quality, while the uncertain group performed the three production strategies in a relatively well balanced way. These findings suggests that the uncertain group has no dominant production strategy. On the other hand, the complex group performed their price/quality centered strategy well. Thus, it was confirmed through this study that our apparel manufacturers put priority on

price/quality centered strategy when viewed as per production environment group. Such a finding forms a striking contrast to the finding that performance level of flexibility centered strategy was highest when viewed in overall terms. All in all, it is conceived that our apparel manufacturers are struggling to survive by applying what is deemed most efficient strategy.

## 2. Relationship Between Group of Production Strategy and Systems

Differences of production system factors per production strategy group were tested as shown in <Table 4>. The delivery centered group showed .7198 of Hotelling's T<sup>2</sup> value (p<.001), while the "F" value of the managers centered group was 18.3924 (p<.001). These findings suggest that production systems adopted differed among groups.

On the other hand, when the performance level of production system factors was analyzed, it was found that the complex group performed best in all three factors, while the production system performed best by apparel manufactures was worker centered system, followed by management centered and product centered ones.

The delivery centered group showed negative

**<Table 4>** Relationship between Group of Production Strategy and Systems

	Management centered system	Product centered system	Worker centered system	Hotelling's T <sup>2</sup>
Complex group	.2659	.0690	.5471	.0949
Delivery centered group	-.5790***	-.2598	-.1662	.7188***
Price/quality centered group	-.1973	-.3455	.5441	.1930
Flexibility centered group	.1876	.3204	-1.043	.1753

\*\*\* p<.001.

scores in all the three factors of production system, which suggests that they performed poor in this area. The area which scored a lowest point was worker centered system, followed by product centered and managers centered ones in their order. In particular, since this group's score in worker centered system was much lowest, their production system management as a whole was affected more negatively.

The price/quality centered group scored highest in worker centered system, followed by managers centered and product centered systems, but their score in worker centered system was positive, which means that they performed more in this area than the other areas.

On the other hand, the flexibility centered group showed highest score in product centered system, followed by managers and worker centered systems. This group's score was positive only in product and managers centered systems.

As discussed above, complex and price/quality centered groups performed their worker centered system best, while flexibility centered group performed the product centered system best. Such findings suggests that the former two groups have more processes of their production system and that the latter group operate their production system centered about products.

### 3. Relationship Between Group of Production

#### Strategy, Production System and Performances

##### 1) Group of Production Strategy and Performances

The differences of performances among production strategy groups were tested, and the results are presented in <Table 5>. As shown in the table, significant differences were found only in relative market share and on-time delivery ( $F=3.639$ ,  $p<.05$ ,  $F=4.554$ ,  $p<.01$ ).

To be more specific, flexibility centered group, complex group and delivery centered group scored higher in relative market share than price/quality centered group. The competitiveness of major product was higher in flexibility centered and complex groups, followed by delivery centered and price/quality centered ones. On the other hand, complex group, flexibility centered and delivery centered groups scored higher in on-time delivery than price/quality centered group. The factory operation ratio was similar among flexibility centered, delivery centered and complex groups, all of which showed higher values of this ratio than price/quality centered group.

All in all, in relationship between production strategies and performance, complex group, delivery centered and flexibility centered groups showed similar performances, but scored higher than price/quality centered group. Such findings

<Table 5> Relationship between Group of Production Strategy and Performances

	Complex group	Delivery centered group	Price/quality centered group	Flexibility centered group	F-value
Relative market share	3.44 A	3.28 A	2.87 B	3.52 A	3.639*
Competitiveness of major product	3.91	3.72	3.52	3.94	1.949
Rate of on-time delivery	89.29 A	87.62 A	82.68 B	88.65 A	4.554**
Factory operation ratio	84.29	84.41	77.93	84.88	1.849

A: Different characters are used for the groups showing different performances at the level of  $p<.05$  as a result of Duncan test.(B<A).

\* $p<.05$ , \*\* $p<.01$ .



in all suggests that it will be more effective for apparel manufacturers to depart from their conventional price/quality centered strategy to rely on complex strategies or enhance their flexibility or delivery strategies.

#### 2) Group of Production System and Performances

Differences of performances were tested per production system group, and the results are presented in <Table 6>. Such performance variables as competitiveness of major product and factory operation ratio differed among groups ( $T=2.747$ ,  $p<.01$ ,  $T= 2.774$ ,  $p<.01$ ), which is contrasted well with the finding that relative market share and on-delivery differed significantly in the analysis of the relationship between production strategies and performances. Managers centered system group scored higher than worker centered system group in relative market share, competitiveness of major product, on-time delivery and factory operation ratio.

As discussed above, in view of the finding that managers centered system is more effective than worker centered system in all areas of performances, it will be more desirable for our apparel manufacturers to focus their production management on control of processes.

### IV. Conclusions

Uncertainty and complexity of market situation has forced manufacturer to develop productive strategy and system. This is a succession of which research classifies the scope of production management to be pressed by labor cost and various market demands. Given such conditions,

the study aims to review the production strategies and systems in apparel manufacture and thereby, determine the relationship between production management variables and company performance. To this end, the following three-fold research points are set up; First, differences of production strategies be examined depending on group of production environment; Second, differences of production system be analyzed depending on group of production strategy; Third, the effects of production strategy group and system group on company performances be analyzed.

The following are the results of this study.

1. Concerning production strategy due to group of production environment, the stable group and the complicated group prefer to price/quality centered strategy but the level of usage for strategies is so pretty that it is no significant to carry out them. This means that manager is awakened to production environment in apparel manufacture comparing to others but don't make an appropriated production strategy depending on production environments.
2. Concerning production system due to group of production strategy, the workers centered group is occupied high in the price/quality centered group & the complex group. And also the product centered system is occupied high in the flexibility centered group.
3. Concerning company performance due to group of production strategy and system, the price/quality centered group holds low position of performance comparing to another groups. And the performance of the managers centered group is higher than

<Table 6> Relationship between Group of Production System and Performances

	Managers centered group	Workers centered group	T value
Relative market share	3.43(.95)	3.24(.93)	1.385
Competitiveness of major product	3.99(.84)	3.65(.90)	2.747**
Rate of on-time delivery	88.98(7.95)	86.74(8.92)	1.836
Factory operation ratio	86.37(12.89)	80.88(14.48)	2.774**

\*\* $p<.01$ .

that of the workers.

Based on the above research, in order to improve company performance it is profitable to hold the delivery centered group, the flexibility centered group and the complex group in production strategies, and also to hold the managers centered group in production system. This means that in spite of difference according to each production system, environment and strategy, they have been selected by the subjective choice of managers. Therefore, in order to increase the production of high value-added products in apparel manufacture, he should have just the production strategy and system to be suitable for himself. That will make him the best performances.

In this research, company performance was located with only production management scope (strategy, system, environment) without another activities such as marketing and so on. Therefore, hereafter, it could be required the research which defines the relative strategy between production scopes and others.

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