

The Impact of Difference of Linkages between Manufacturing Strategy and Action Plans - An Empirical Comparison of U.S. and Korean Manufacturers -

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Abstract It is important to find the competitive priority, which makes a great contribution to the action plans. The reason is that this makes it possible to provide Korean manufacturers with effective behavioral model to break through the depression after 1997' financial crisis in Korea. Focused priority has become a focus of organizations faced with the need to survive in a highly uncertain business environment characterized by rapid technological change, global competition, and demanding customers. Many believe that better linkages of priority and action plans are fundamental to surviving in the world market. However, there was little previous research dealing with the relationship between the strategic priority and action plans in the view of competitive weapon. This study presents empirical findings on differences between U.S. and Korean manufacturing approach to relationship of priority and action plans. Specially, Korean manufacturers are eager for good model to overcome depression of 1997' financial crisis in Korea. Data was collected as part of the Manufacturing Futures Project completed in 1996. The results indicate that U.S. manufacturers maintain focused linkages from priority to action plans than do Korean manufacturers.

1. INTRODUCTION

Change is a global trend today. Crucial changes that Korean manufacturers are facing are a steep rebound in wage and lack of field workers as Korean economy is recovering from financial crisis of the end of 1996. On the other hand, education level of workers is higher compared in the past. Korean manufacturers can not compete in the global market with low priced product made by mass production any more, but should accelerate the efforts in developing higher value added products. Consequently, Korean manufacturers should set up new manufacturing strategies.

U.S. manufacturers have been one of the most profitable industries in the world business market for the last century. Although they had been outrun by Japanese manufacturers in the 80's in some manufacturing fields like auto industry, US manufacturers have quickly regained the leading position in the world market through business restructure and technical reorganizations and changes.

In this paper, although there are still some differences between U.S. and Korean manufacturers in scale, structure, management style and other dimensions, we explore the linkages of competitive priorities and action plans.

The purpose of this paper is twofold. First, we seek to investigate the differences of linkage competitive priorities and action programs between U.S. and Korea manufactures. The second major purpose of this paper is to suggest that new manufacturing strategy will be

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needed to overcome economic crisis and to keep up with developed countries in Korean manufacturers.

2. LITERATURE REVIEW

2.1 Competitive Priority in manufacturing Strategy

Skinner (1969) suggested not only the neglect of the manufacturing function as strategic element of the planning process, but also four possible manufacturing strategies: cost, quality flexibility, and deliver and pointed out the linkage between manufacturing and strategic planning was elusive and ill-defined. Hayes and Wheelwright (1984) have covered the role of manufacturing strategy in the strategy formulation and the strategy implementation process of a business unit. They (1984) defined competitive priority as Price, Quality and Dependability, and Flexibility. Similarly, Ferdows and De Meyer (1990) identified four generic manufacturing capabilities: Cost efficiency, Quality, Dependability and Flexibility.

Hill (1989) outlined a set of 'order-winning criteria' that fall under the broad auspices of manufacturing. These criteria are included: Price (low manufacturing cost), Product Quality (conformance or specification) and reliability (delivery speed, delivery reliability, and the ability to respond to increases in demand). Specifically, he emphasized on non-manufacturing competitive priority such as after-sales service, technical liaison and support, meeting a launch date, product design and product customization.

Manufacturers pursuing a low-cost strategy seek stable and predictable markets to minimize product adaptation costs and to achieve economies in manufacturing (Miller, 1980). Internally, the emphasis is on cost reduction because this strategy is dependent on a firm's ability design, produce and market comparable product more efficiently than its competitors (Kotha and Swamidass, 2000).

2.1 Impact of Linkage of Competitive Priority and Action plans

To effectively link the manufacturing strategy of an organization to the goal of organizational performance,

critical competitive factors must be understood both by operations and marketing managers (Hill, 1983).

In the late 1970s, Wheelwright (1978) identified the most important general criteria for evaluating manufacturing performance: efficiency, dependability, quality, and flexibility. A few years later, Schmenner (1981) described the diversity and number of competitive demands placed upon manufacturing. He identified eight 'competitive demands' that fell into three distinct groupings. The groupings were product-related (i.e., product performance such as design and conformance, product reliability, product durability, product customization, and new product introduction); delivery related (i.e., speed of delivery, delivery reliability, volume flexibility); and cost-related (i.e., cost to produce).

In the 1980s, Hambrick (1983) found a positive correlation between business unit performance and technology protection and added a positive correlation between both capacity and utilization and breadth of product line. In addition, the correlation between business unit strategy and manufacturing strategy that has been suggested by researchers (Kotha and Orne 1989, Fine and Hax 1985)

In the 1990's, different competitive priorities are related with different action programs. Particular competitive priorities would greatly enhance the payoff of certain action programs. The design of manufacturing systems should focus on developing competitive capabilities that satisfy customer needs and improve performance through action programs (Ward et al., 1994). Porter (1996) claimed that a proper linkage between strategy and operations is a key to developing a sustainable competitive advantage. Upton (1994) stated that firms must match their manufacturing systems capabilities with their strategic competitive priority in order to be successful. Park et al. (1996) in their joint research stated that high performing SMEs (small and medium enterprises) adopt different competitive priorities than do low performing SMEs in the same environmental context. Chen et al (1992) addresses the impact of manufacturing flexibility provided by recent evolving computer and process technology including CAD, CAM, CAPP and FMS. Lapiere et al examined an exhaustive set of relationships among important evaluation and post-purchase concept (1999).

However, there are little researches on relationship

between manufacturing strategy and action plans. Katayama and Lee et al. (1996, 1997) suggested behavioral difference between vigorous and unvigorous Japanese electro-electric companies by stating that there are different linkages between competitive priorities and action programs in the two kinds of manufacturers.

3. RESEARCH METHODOLOGY

3.1 Data set from a survey: Manufacturing Futures Survey Program

On manufacturing strategy, Ferdows and De Meyer (1990) suggested a new model of the relationships among competitive capabilities in manufacturing strategy, called by the cumulative or sand-cone model. In the model, it was asserted that there is a pre-specific priority of manufacturing strategy such as quality, dependability, speed and cost efficiency, for lasting improvements in manufacturing capabilities.

The behavioral model of manufacturing companies settled as MFP scheme is the stream of their competitive priorities based on business strategies and their profile, their action programs based on competitive priorities and their performance results based on action programs. Competitive priorities mean the pattern of priority assignment to each manufacturing strategy, e.g. cost/price competitiveness(C), quality competitiveness(Q), delivery competitiveness(D), flexibility competitiveness(F) and service competitiveness(S). Action programs mean companies' activities to accomplish objectives settled by manufacturing strategy, and this category includes "worker training", "management training", "supervisor training", "CAM", "CAD/CAE", "CIM", "new process development for new products", "new process development for old products", "integrating information systems within manufacturing", "integrating information systems across functions", "integrating information systems with suppliers and distributors", "SPC", "TQM", "TPM".

The sub-variables in competitive priority, and action programs are marked from 1 (Little payoff) to 7 (Great

payoff) based on the extent of payoff resulting from these programs or activities in the past two years.

3.2 Data Collection

Data from Korean manufacturing companies were collected as a main activity of MFP-Korea by sending the questionnaire booklets to operation vice-presidents or directors who are relatively high-level managers in large manufacturing corporations in 1996.

Data from USA manufacturing companies were collected by the MFP-USA located at Boston University in 1996. The MFP started in 1981 and quickly became a major force in the manufacturing research community by systematically collecting and analyzing a rich set of data from about 200 large successful manufacturers every other year.

The trends and patterns identified from this survey data have been a useful resource in developing manufacturing strategy theories. Now, this project covers the other three economic super-power regions: USA, European Union and Japan - through a partnership with Boston, INSEAD and Waseda University. The MFP is also conducted in rapidly developing nations like Korea, Taiwan, Singapore, China, Australia, New Zealand, Mexico, and South Africa.

4 .RESEARCH HYPOTHESES

This research empirically examines the importance of different competitive priorities determined by manufacturing companies in USA and Korea, as well as the relationship between competitive priorities and action programs in the manufacturing companies in the two countries. For this, we test two hypotheses:

Hypothesis 1: There is a significant difference in the importance of competitive priorities between U.S. and Korean manufacturers.

Hypothesis 2: There are different relationships between competitive priorities and action programs in U.S. and Korean manufacturers.

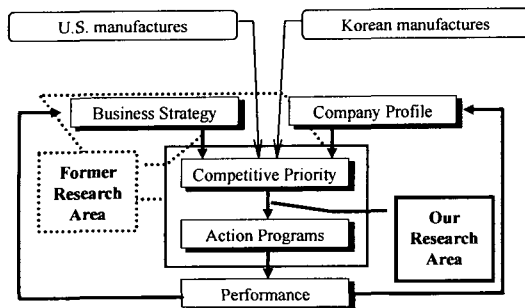


Figure 1. The MFP framework and analytical stand point

4.1 Analysis process

First, the values of competitive priorities (independent variables) are conducted by independent t-test to see if there is statistical difference in competitive priorities between U.S. and Korean manufacturers. 90% confidence level is selected.

Second, for each independent and dependent variable, factor analysis is applied to see if the grouped sub-variables are good representatives of the variable and could be treated as one factor. The sub-variable that has a factor loading value of more than 0.500 is selected and retained in that group.

Third, multivariate regression is applied to the five competitive priorities (independent variables) and the five main action programs (dependent variables) in order to analyze the relationship between each independent

and dependent variables. 90% confidence level is selected.

5. RESULTS and FINDINGS

5.1 Independent Samples T-test of variables between USA and Korea

In order to test whether there exist statistical differences in the competitive priorities between USA and Korea, independent sample t-test is applied (see table 1). The means values and significance for the competitive priority and action plans provided on the table 1. Korean manufacturers was reported higher level of ability to make rapid design change introduce new products quickly, Ability to make rapid volume changes, Ability to introduce new products quickly, Ability to make rapid product mix changes, Ability to offer consistent quality with low defects, Ability to provide effective after-sales service, and Ability to customize products to individual customer's needs, while U.S. companies appeared Ability to profit in price competitive market, Ability to provide durable products in competitive priority.

We interpret this as how Korean manufacturers emphasize on most of competitive priority while US companies emphasize on specific competitive as a competitive force. Ironically, Korean companies also

Table 1. Independent Samples T-Test between USA and Korea

Variables	USA	Korea	
Ability to profit in price competitive market	5.8647	5.5899	*
Ability to make rapid design changes	4.9023	5.5000	***
Ability to introduce new products quickly	5.4427	5.7591	**
Ability to make rapid volume changes	4.7121	5.3261	***
Ability to make rapid product mix changes	4.9398	5.4493	***
Ability to offer a broad product line	5.1805	5.1324	
Ability to offer consistent quality with low defects	6.3083	6.4710	*
Ability to provide high-performance products	5.5188	5.4963	
Ability to provide reliable products	6.2030	6.0370	
Ability to provide durable products	5.0992	4.7778	*
Ability to provide fast deliveries	5.7970	5.7986	
Ability to provide dependable deliveries	6.0602	5.9855	
Ability to provide effective after-sales service	5.0301	5.9348	***
Ability to provide effective product support	5.3485	5.4203	
Ability to customize products to individual customer's needs	5.2045	5.8261	*

*p ? 0.1; **p ? 0.05; ***p ? 0.01

reported higher level of all of action programs than U.S. companies in the action programs (see the table 2).

These results suggest that Korean manufacturers emphasize all of competitive priority and action programs without focuses in setting up manufacturing planning control, while U.S. manufactures have focuses on their competitive advantage.

Through these results, we think that simple comparison of competitive priority and action plans between two countries is less important, because respondents may have difference of criteria in the questionnaires. On the other hand, it is important to find the competitive priority, which makes a great contribution to the action plans. The reason is that this makes it possible to provide Korean manufacturers with effective behavioral model to break through the depression after 1997' financial crisis in Korea.

The purpose was to determine empirically which of three variable grouped together to form areas of performance strength. One factor was retained as shown as the table 3.

There were several reasons for choosing one factor. First, in both the U.S. and Korea manufacturers, the extract method was used eigenvalue greater than 1 rule of thumb, and pointed the same one factor using the same method. Second, in service and manufacturing, the scree plot pointed to one. Third, the rotated factor pattern was clean; the loading of each of the seven abilities on its respective factor was well over 0.60 (see the table 3 and table 4). This pattern of loading is characteristic of clean solution. Finally, the factors were interpretable.

The competitive priority, Price has only one variable,

Table 2. Independent Variables T-Test between USA and Korea

Variables	USA	Korea	
Working training	4.5854	5.0451	***
Management training	4.1250	5.0075	***
Supervisor training	4.1600	5.0527	***
Computer-aided manufacturing	4.0485	4.4054	*
CAD/or computer-aided engineering	4.3866	4.7264	*
Computer integratde manufacturing	3.7742	3.9891	***
Developing new process for new products	3.9545	4.5161	***
Developing new process for old products	4.0721	4.7402	***
Integrating IS within manufacturing	3.9492	4.6589	***
Integrating IS across functions within the business unit	3.7255	4.5954	***
Integrating IS with suppliers and distributors	3.4592	4.1818	***
Statiscal quality control	4.0085	4.6818	***
Total quality management	4.0261	4.8346	***
Total productive maintenance	3.7396	4.7820	***

*p ? 0.1; **p ? 0.05; ***p ? 0.01

5.2 Factor analysis of competitive priority and action program in USA and Korea

In order to test whether the variables we selected are good representatives of each competitive priority, factor analysis is applied to each of the four following competitive priorities: Flexibility, Quality, Delivery and Service (see the table 3).

At first, Flexibility, Using the performance rating on the three variables as input, a principal components factors with Quartimax and Kaiser Normalization was performed.

Ability to profit in price competitive markets, and it is defined as one factor.

Flexibility consists of five variables: Ability to make rapid design changes, Ability to introduce new products quickly, Ability to make rapid volume changes, Ability to make rapid product mix changes, and Ability to offer a broad product line ability. The factor analysis shows eigen-value of 2.093, Cronbach alpha (Cronbach, 1954) of 0.6481 and percent of variance explained of 41.864% in U.S. while eigen-value of 2.458, Cronbach alpha of 0.7365 and percent of variance explained of 49.164%. So

Table 3. Factor Analysis of competitive priority in USA and Korea

Factor	Variable	USA			Korea		
		Factor loading	Cronbach ? (eigenvalue)	Per. of variance	Factor loading	Cronbach ? (eigenvalue)	Per. of variance
Price	Ability to profit in price competitive market	N/A	N/A	N/A	N/A	N/A	
Flexibility	Ability to make rapid design changes	0.657	0.6481 (2.093)	41.864	0.591	0.7365 (2.458)	49.164
	Ability to introduce new products quickly	0.633			0.692		
	Ability to make rapid volume changes	0.675			0.746		
	Ability to make rapid product mix changes	0.740			0.718		
	Ability to offer a broad product line	0.508			0.748		
Quality	Ability to offer consistent quality with low defects	0.766	0.6335 (2.065)	51.624	0.571	0.6422 (1.957)	48.921
	Ability to provide high-performance products	0.576			0.779		
	Ability to provide reliable products	0.806			0.754		
	Ability to provide durable products	0.705			0.675		
Delivery	Ability to provide fast deliveries	0.870	0.6768 (1.515)	75.731	0.925	0.8305 (1.711)	85.571
	Ability to provide dependable deliveries	0.870			0.925		
Service	Ability to provide effective after-sales service	0.887	0.6681 (1.863)	62.116	0.798	0.6768 (1.824)	60.789
	Ability to provide effective product support	0.877			0.805		
	Ability to customize products to individual customer's needs	0.555			0.734		

the five variables are considered as reasonable representatives of competitive priority of flexibility and are grouped as one factor.

Quality consists of four variables: Ability to offer consistent quality with low defects, Ability to provide high-performance products, Ability to provide reliable products and Ability to provide durable products as described table 3.

Delivery consists of two variables: Ability to provide fast deliveries and Ability to provide dependable deliveries.

Service consists of three variables: Ability to provide effective after-sales service, Ability to provide effective

product support and Ability to customize products to individual customer's needs.

5.3 Factor analysis of action Plans in USA and Korea

Among 44 different Action Plans, we grouped together some variables according to its inner resemblance, and constructed five factors. In order to test whether the variables we selected are good representatives of each group, factor analysis is applied to each of the five following groups: Training, Computer Activities, Product Development, Information Systems

Table 4. Factor analysis of action in USA

Factor	Variable	USA			Korea		
		Factor loading	Cronbach ? (eigenvalue)	Per. of variance	Factor loading	Cronbach ? (eigenvalue)	Per. of variance
Training	Working training	0.868	0.8815 (2.428)	80.926	0.860	0.8744 (2.401)	80.035
	Management training	0.922			0.901		
	Supervisor training	0.909			0.923		
Computer Activities	Computer-aided manufacturing	0.830	0.8023 (2.150)	71.669	0.798	0.7115 (1.901)	63.810
	Computer-aided design and/or computer-aided engineering	0.846			0.808		
	Computer integrated manufacturing	0.864			0.791		
Product Development	Developing new process for new products	0.913	0.7992 (1.667)	83.359	0.900	0.7606 (1.619)	80.942
	Developing new process for old products	0.913			0.900		
Information Systems	Integrating information systems within manufacturing	0.901	0.8083 (2.181)	72.708	0.888	0.7901 (2.151)	71.687
	Integrating information systems across functions within the business unit	0.877			0.893		
	Integrating information systems with suppliers and distributors	0.774			0.751		
Quality Management	Statistical quality control	0.803	0.6909 (1.879)	62.642	0.867	0.8264 (1.879)	74.237
	Total quality management	0.887			0.902		
	Total productive maintenance	0.668			0.813		

and Quality Management (see table 4).

5.4 Multivariate Regression analysis between manufacturing strategy and action plans in USA

Multivariate Regression analysis is conducted for USA companies. The five factors composed of competitive priorities are treated as independent variables and the five factors composed of action plans are treated as dependent variables (see figure 1).

At 90% confidence level, Price is positively related with computer activities (Beta=0.229). Flexibility is positively related with training factor (Beta=0.366), computer activities (Beta=0.294), Product development (Beta=0.517), and information systems (Beta=0.423). Quality is positively related with Computer activities (Beta=0.385). Service is positively related with Computer activities. However, Delivery is not correlated with any

independent factor at 90% confidence level.

On the other hand, At 90% confidence level, the regression for training factor includes only one independent factors: Flexibility. The regression for computer activities consists of price, flexibility and quality. The regression for Information Systems factor includes two independent factors: Flexibility and Service.

The regression for Product development factor consists of only one independent factor: Flexibility.

However, The regression for Quality Management factor is not correlated with any independent factor at 90% confidence level.

5.5 Multivariate Regression analysis between manufacturing strategy and action plans in Korea

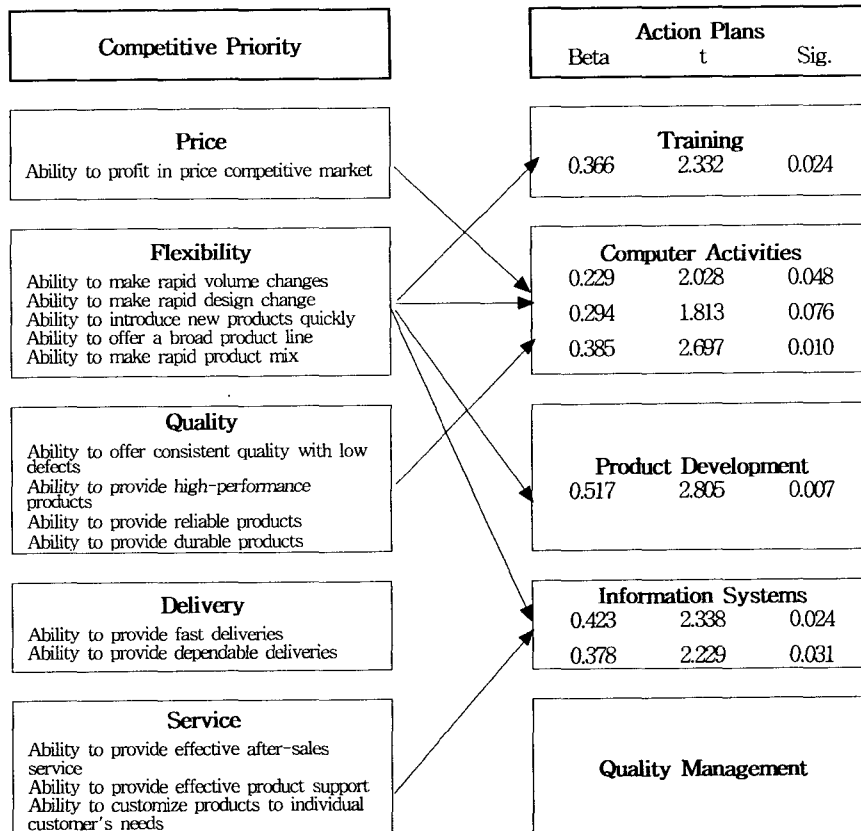


Figure 2. The linkages between Manufacturing Strategy and Programs / Activities in USA

Regression analysis is conducted for Korean

companies. The five competitive priorities factors are also treated as independent variables and the five action plans factors are treated as dependent variables (see figure 3).

At 90% confidence level, the regression for Computer Activities factor includes only one factor, Delivery. Here, Delivery (Beta=0.342) is positively related with Computer Activities factor. The regression for Product Development factor includes only one independent factor, Price. Here, Price (Beta=-0.164) is negatively related with Product Development factor. The regression for Quality Management factor includes two independent factors, Delivery and Service. Here, Delivery (Beta = 0.278) and Service (Beta=0.274) are positively related with Quality Management factor.

6. Conclusions

Multivariate regression is conducted to find the relationship between competitive priorities and action plans in the two countries' manufacturing companies.

In USA, when the importance of price is increased, the payoff from computer activities is increased. When the importance of flexibility is increased, the payoff from training, computer activities, product development and information systems is increased. When the importance of quality is increased, the payoff from computer activities is increased. When the importance of service is increased, the payoff from information systems is increased.

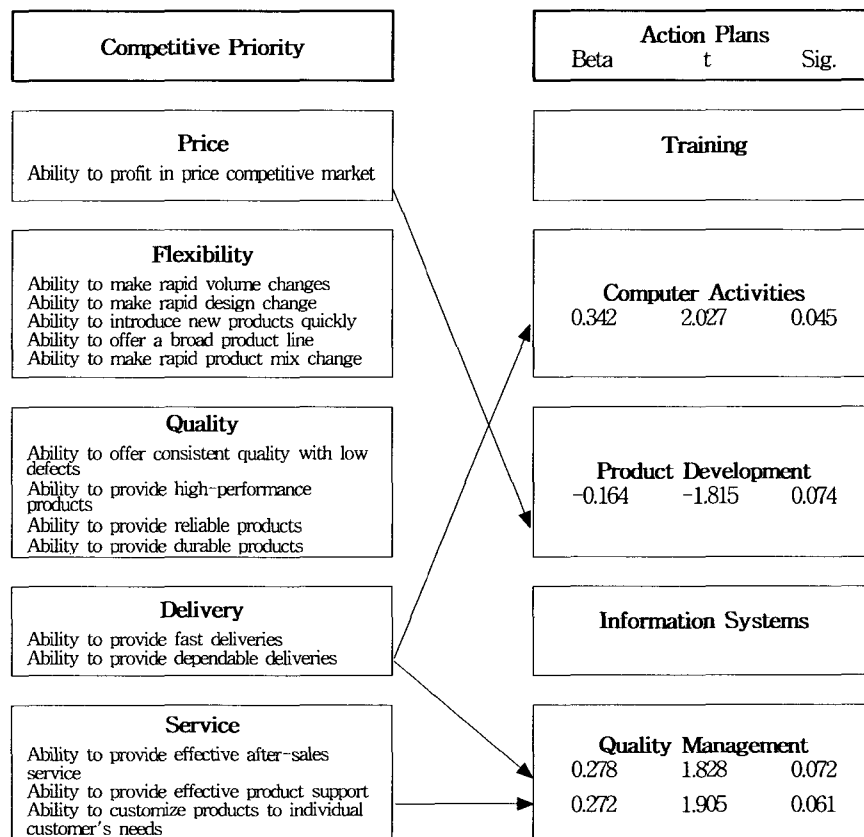


Figure 3. The linkages between Manufacturing Strategy and Action Plans in Korea

In Korea, when the importance of price is increased, the payoff from product development is reduced. When the importance of delivery is increased, the payoff from computer activities and Quality management is increased. When the importance of service is increased, the payoff from quality management is increased.

From above, it can be seen that hypothesis 2 is well supported. In general, the increase in the importance of flexibility would enhance payoff from various action plans in USA manufacturing companies. Other competitive priorities would also enhance payoff from certain action plans. On the other hand, the increase in the importance of price would reduce payoff from specific action plans while the increase in the importance of delivery and service would increase payoff from Computer Activities and Quality Management in Korea.

These results imply that US manufacturers have systematic linkages between Competitive priority and action programs but Korean manufacturers do not have systematic linkages between competitive priority and action programs.

7. Suggestions

To make systematic linkages between competitive priority and action programs in Korea, It is necessary legitimate manufacturing strategy framework. Specially, Korean manufacturers are eager for better model to overcome depression of 1997' financial crisis. Our research indicates that U.S. manufacturers maintain focused linkages from priority to action plans than do Korean manufacturers.

In order to survive uncertain environment the firm should pursue maximization of profit. To secure profit, existence of customers is essential, and to secure customers, quality of the product should be competitive. High quality requires technology, which is developed in the production field and accumulated in employees brain.

Therefore, profit is yesterday's target; satisfying customers is today's object. And technological innovation through development of human resources is tomorrow's goal. Nevertheless, many firms tend to be

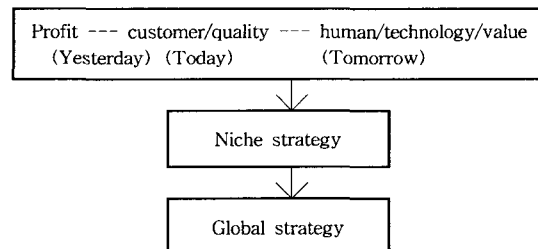


Figure 4. Production strategy of Korean manufacturers in the informationalization era

concerned about only profit taking which was yesterday's target, neglecting importance of customer satisfaction and innovation through human resources development, which are present and future's goals.

Investment in R&D for the purpose of ultimate innovation requires shift of corporate goal from profit maximization to development of human resources. In order for firms to shift from yesterday's goal to tomorrow's goal, they need corporate value, which can work as driving force to reach all the goals. If corporate value exists, the firm will try to become world-class company by concentrating on selective business, instead of expanding to variety of business. Global strategies may come up as natural result when many Korean entrepreneurs bear corporate values in their mind. Today's corporations have to compete in the global arena (Rho 1993).

Consequently the ultimate strategy which firms have to resort to would be a global one, and what makes global strategy is niche strategy. Both global and niche strategies come up from combinations of strategies (Porter, 1985, 1986).

Niche strategy focuses on penetration into a small but specialized market where competitors cannot easily enter. In other words, it concentrates intensively on subdivided sector of market and certain customer group. Since niche markets exist as small sector, unlike other firms dealing with general markets thus focusing on cost strategies or discrimination strategies, niche market player should approach it with global strategies. Under global strategy, a firm needs to have global perspective especially in responding to its customers. Responding to customers here includes offering quality, service, and

delivery to need of customers. Therefore, all the systems exist to manage human resources in the sense that they emphasize production fields. Responding system to customer starts from marketing concept focusing on customers, but is corporate management system. Value creation for customer is matter for all (Ono 1978, Moden 1997).

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서강대학교에서 경영학 전공 경영학 학사 (BA)와 문학석사 (MA) 학위 취득
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