Impact of Quality Management Practices on Suppliers' Quality Performance: Empirical Evidence from Korean Automotive Parts Suppliers

Seungwook Park[1†], Youn Sung Kim[2], and Peng Chan[3]

[1] California State University-Fullerton, USA

[2] College of Business Administration
Inha University, Incheon, Korea

[3] California State University-Fullerton, USA, Tel: 714) 278-7340
E-mails: [1]spark@fullerton.edu, [2]keziah@inha.ac.kr, [3]pchan@fullerton.edu

Abstract

Recent research on quality management systemically explored the use of quality management practices and performance. The consequences of using quality practices have not been consistently confirmed despite an increasing number of published empirical studies. The results of empirical studies of quality practices and performance are mixed. This study examines which quality management practices indicate high-, medium-, and low-performance under the TQM framework using MANOVA and multiple discriminant analysis (MDA). To measure quality management practices, this study used the Malcolm Baldrige National Quality Award (MBNQA) framework. Based on a survey of 490 suppliers from eleven different industries in Korea, the results revealed that the high performing group surpasses the medium and low performing groups in process management, employee empowerment, employee education and training, and employee satisfaction. Furthermore, the high and medium performing groups exceed the low performing group in human resource planning and evaluation, strategic deployment, leadership system, and senior executive leadership.

1. Introduction

Since the early 1980s when quality emerged as an important competitive priority, several studies have explored the relationship between quality management practices and performance. Early publications were more like anecdotal evidence of the benefits of quality management. Consulting firms and business organizations began to survey on the benefits of quality practices (Hiam, 1993). Later, researchers systemically explored the use of quality management practices and performance. Unfortunately, the consequences of using quality

† Corresponding Author

practices have not been consistently confirmed despite an increasing number of published empirical studies. Considered as a whole, the results of empirical studies of quality practices and performance are mixed. The findings show no clear direction on which quality practices lead to improved performance under what conditions.

In fact, drawing conclusions from the past literature on quality is challenging for several reasons. First, most researchers developed their own measures for quality practices so the same constructs were often measured slightly differently in each study. Second, a variety of different performance measures have been used. Some studies used product quality as Flynn *et al.* (1995), while others used customer satisfaction (Grandzol and Gershon, 1997) and financial performance (Ittner and Larker, 1997). Third, most importantly, most empirical studies of quality management gathered data on quality practices and performance from a within firm perspective (e.g. Adam, 1994; Ahire and O'Shaughnessy, 1998; Choi and Eboch, 1998; Flynn, Schroeder, and Sakakibara, 1995; Forker, 1997; Grandzol and Gershon, 1997; Handfield and Ghosh, 1995; Hendricks and Singhal, 1997; Ittner and Larcker, 1997; Powell, 1995). The use of self-reported data causes common method variance (CMV) that is a well-known threat to construct validity in the empirical study.

In this study, quality management practices were reported by first-tier automotive suppliers, but performance data of each supplier were gathered from its buyer. The buyer, which is the automobile assembler, calculated its suppliers' performance based on 1) the number of incoming parts rejected at the assembly plants, 2) the number of defects found during finished goods inspection of the assembled automobiles, and 3) the number of defects found after sales based on warranty claims and after sales service data. This calculation was then classified by the buying company into three groups: high performers, medium performers, and low performers of the suppliers. To measure quality management practices, this study used the Malcolm Baldrige National Quality Award (MBNQA) framework which is one of the most comprehensive frameworks used by the U.S. government in evaluating and awarding the best performing companies in manufacturing, service, and small business areas every year. The MBNQA is also one of the most frequently used framework in the production and operations management literature and other management fields, and its reliability and validity have been rigorously tested (Adam, 1994; Curkovic and Handfield, 1996; Park *et al.*, 2001).

This study examines which quality management practices indicate high-, medium-, and low-performance under the TQM framework. It has been reported that quality management practices contribute to quality, overall firm performance, and ultimately to gaining a competitive advantage (Garvin, 1987). However, the literature shows mixed results on which quality practices are the most likely to improve quality. This study examines whether high performing firms excel low performing firms in a different bundle of quality practices using MANOVA and multiple discriminant analysis (MDA).

2. Literature Review

Some early studies have failed to confirm a strong relationship between the adoption of quality management practices and conformance quality. Adam (1994) did a cross-industry survey of quality and productivity management practices based on the MBNQA Criteria. Using regression analysis, significant relationships were found between the use of quality management techniques and self-reported measures of quality performance including returns and warranties, and rework, but the explained variance was not significant. Adam (1994) concluded that many quality practices have little practical impact on performance.

Other empirical studies have explored the relationship between quality management practices and quality. Flynn, Schroeder, and Sakakibara (1995) explored the quality management practices of high, medium, or low performing plants based on self-reported yield rates. They showed that process control was used more often by high performers than low performers did. However, the other quality management practices including employee involvement, new product quality, concurrent engineering, feedback, and maintenance showed that the high and low performers used more often than the medium performers. The authors explained that perhaps low performers, aware of their problems, were emulating the practices of high performers but had not yet attained the performance advantages.

Grandzol and Gershon (1997) studied the quality management practices used by US defense contractors from the aerospace, tooling and engineering industries. One of the seven quality management practices studied, continuous improvement, was related to self-reported operational quality. Operational quality was a very broadly defined construct that included measures of defect rate, productivity, cycle time, energy/efficiency, and material usage. A survey of Ohio plant managers based on the MBNQA found that process quality, human resource management, and information and analysis were positively correlated with product quality (Choi and Eboch, 1998). No statistically significant relationship was found between strategic quality planning and product quality in this study.

One empirical study of suppliers in the US and Canadian automotive industry focused on the relationship between TQM practices and overall product quality (Ahire and O'Shaughnessy, 1998). Plant managers in the automotive parts industry were surveyed to determine their use of quality management practices and perceived product quality relative to their competition. The results showed that greater customer focus, supplier quality management, and employee empowerment were related to higher product quality. Although top management support was not directly related to product quality, the findings suggest that top management commitment affects the implementation of other management practices.

Forker (1997) studied quality management research in a supply chain context. This study compared suppliers' quality practices to defect rates of parts as measured by a buying firm in the aerospace industry. The buying firm provided data on the defects and field failures that were attributed to each supplier. The results of this study did not find a significant direct relationship between suppliers' quality practices and defects of the supplied parts. When interactions between the use of quality practices and their efficiency of the use were considered using data envelopment analysis (DEA), several significant relationships were found. Efficient implementation of product design, employee training, and employee relations within the supplier's firm were related to fewer defects. Similarly, Ahire, Waller, and Golhar (1996) suggested that the effective execution of TQM is related to quality performance.

Kaynak (2003) studies that quality practices have direct and indirect effects on quality performance using cross-sectional survey data. From the analysis of structural equations model, she found that there is a positive relationship between the extent to which companies implement TQM and firm performance. Process management and product/service design practices have direct effects on quality performance. Other practices including leadership, employee relationship, training, supplier quality management, and quality data and reporting have indirect effects on quality performance. The study used self-reported performance data in multiple levels.

Published empirical research results provide no conclusive evidence that quality management practices consistently or measurably improve quality performance. A summary of the quality management practices that were significantly related to firm's quality performance is provided in Table 1. Based on the literature, human resource management and process management are the most promising of the quality management practices for improving quality performance.

Table 1. Literature Review Summary: Quality Management Practices Positively Related to Quality Performance

Past Literature	Quality Management Practices					
	Leadership	Strategic Planning	Information Management	Human Resource Management	Process Management	Product Design
Flynn *et al.* (1995)					×	
Handfield and Ghosh (1995)		×			×	
Grandzol and Gershon (1997)					×	
Forker (1997)				×		×
Choi and Eboch (1998)			×	×	×	
Ahire and O'Shaughnessy (1998)				×		
Dow *et al.* (1999)	×			×		
Samson and Terziovski (1999)	×			×		
Ahire and Dreyfus (2000)					×	×
Kaynak (2003)					×	×

3. Research Methodology

3.1 Target Population and Survey Procedure

The sampling process was initiated to measure the suppliers' use of quality management practices at the plant level. Quality managers were the target respondents within the supplier companies because of their knowledge of the practices actually being used. The survey population was the entire set of qualified first tier production materials suppliers (490 firms) to a major Korean automotive assembler. The buying company provided the mailing list for its suppliers. Surveys were mailed and 121 useable surveys were received from a single mailing for an initial response rate of 24.7%. This response rate compares favorably to other empirical quality management studies (e.g., Flynn, Schroeder, and Sakakibara, 1995; Powell, 1995).

The responding suppliers reported an average of 397 employees and represented eleven different industries. The largest number of suppliers produced fabricated metal products (39%) with the next largest group producing electronic and other electric equipment (19%), followed by suppliers of primary metals (15%) and rubber and plastics products (13%).

Next, performance data for the suppliers were gathered from the buyer, which is the automotive assembler. The buying company calculated its suppliers' performance based on 1) the number of incoming parts rejected at the assembly plants, 2) the number of defects found during finished goods inspection of the assembled automobiles, and 3) the number of defects found after sales based on warranty claims and after sales service data. Since the supplier rating information is highly confidential, we could not obtain the raw scores of supplier evaluation from the auto assembler in spite of our significant effort. Instead, the buying company classified all 490 first-tier suppliers into three groups: high performers, medium performers, and low performers of the suppliers. Based on the classification, 52 survey respondents fall in high performing group; 44 respondents in medium performing group; 25 respondents in low performing group.

3.2 Construction of Survey Instrument and Measures

The survey instrument incorporating 15 scales was derived from the 2001 Malcolm Baldrige National Quality Award (MBNQA) criteria. The 15 scales are shown in Table 2. The MBNQA criteria have generally been accepted in both the academic and practitioner literature (e.g., Black and Porter, 1996; Dean and Bowen, 1994; Grandzol and Gershon, 1997; Handfield and Ghosh, 1995). In this study, existing scales designed to measure dimensions of the MBNQA criteria were used when possible (e.g, Flynn, Schroeder, and Sakakibara, 1994; Saraph, Benson, and Schroeder, 1989). In cases where new scales or scale items were developed, they were directly linked to the 2001 MBNQA criteria.

Table 2. Quality Management Practice Constructs in MBNQA Criteria

Quality Management Practices	Variable Name
1. Senior executive leadership	LEXE
2. Leadership system,	LSYS
3. Corporate responsibility and citizenship	LPUB
4. Management of information and data	INFR
5. Competitive comparison and benchmarking	BNCH
6. Analysis and use of company-level data	ANAL
7. Strategy development	STDV
8. Strategy deployment	STDP
9. Human resource planning	HPLN
10. Empowerment	HEMP
11. Education and training	HEDU
12. Employee well-being and satisfaction	HSAT
13. Product development and process design	DSGN
14. Process Management	PROS
15. Management of supplier performance	SMGT

Initially, an English version of the survey instrument was developed. Then, the instrument was translated into the Korean language. A bilingual native of Korea proofread the English version and noted ambiguities and jargon that could cause confusion in translation. After these were revised, the instrument was translated and then reviewed by several Korean scholars familiar with quality management concepts. The Korean version of the instrument was then pilot tested by a mailing to Korean suppliers to the automotive and shipbuilding industries. Out of 50 surveys mailed, 31 were returned. The results of reliability analysis on the survey instrument showed Cronbach's alpha were above 0.7 for all scales except one, *information management and data.* This scale was reworded to correct a problem with translation.

3.3 Tests for Reliability and Content Validity

A measurement instrument is reliable if repeated administration of the instrument to the same population yields the same results assuming that no real changes have occurred. Internal consistency as indicated by Cronbach's alpha is the most common test for scale reliability found in the literature (e.g., Flynn, Schroeder, and Sakakibara, 1994; Saraph, Benson, and Schroeder, 1989). Cronbach's alpha values of 0.7 or higher are considered to be acceptable for new scales (Nunnally, 1978). Initial analysis revealed that the Cronbach's alpha for the *design and introduction of products and services* (DSGN) scale was lower than 0.7. After three items were dropped this scale, Cronbach's alpha values for all the scales ranged from 0.73 to 0.92 as shown in Table 3.

Table 3. Reliability Test and Factor Loadings of Scales

MBNQA Construct	No. of Items in Scales	Cronbach's Alpha	Factor Loading Range
Senior Executive Leadership (LEXE)[1]	6	0.78	.56 to .71
Leadership System (LSYS)	4	0.85	.78 to .84
Corporate Responsibility and Citizenship (LPUB)	4	0.83	.76 to .85
Management of Information and Data (INFR)	6	0.88	.75 to .81
Benchmarking (BNCH)	4	0.90	.83 to .93
Analysis and Use of Data (ANAL)	4	0.72	.67 to .79
Strategy Development (STDV)	6	0.88	.65 to .88
Strategy Deployment (STDP)	5	0.92	.81 to .92
Human Resource Planning and Evaluation (HPLN)	4	0.91	.86 to .92
Employee Empowerment (HEMP)	5	0.86	.77 to .85
Employee Education, Training and Development (HEDU)	6	0.91	.81 to .89
Employee Well-being and Satisfaction (HSAT)	5	0.92	.83 to .91
Design and Introduction of Products and Services (DSGN)[2]	5	0.83	.62 to .88
Process Management (PROS)	6	0.85	.58 to .85
Management of Supplier Performance (SMGT)	4	0.77	.65 to .85

Note: 1. One item in LEXE was dropped to gain a unidimensionality
2. Three items in DSGN were dropped to improve its Cronbach's alpha up to the desirable level

After the reliability of the scales was established, construct validity was determined. Construct validity measures the extent to which all items in a scale measure the same concept. Because the scales were based on the MBQA and existing scales (e.g., Ahire, Golhar, and Walker, 1996; Black and Porter, 1996; Flynn, Schroeder, and Sakakibara, 1994; Saraph, Benson, and Schroeder, 1989), the primary objective was to confirm that the scales formed as expected. Thus, content validity was confirmed by a principal component factor analysis on each scale individually to determine if all of items in the scale all loaded on a single factor. The results showed that 14 of the scales formed as expected with the correct items loading on single factor for each scale. One scale, *senior executive leadership* (LEXE), formed two factors. One item was then dropped to form a single factor scale. The factor loadings for all the items were significantly higher than the acceptable level as shown in Table 3.

3.4 Statistical Analysis

The objective of the statistical analysis was to determine if the low, medium, and high performing suppliers differed based on their use of the quality management practices. First, Bartlett's test of sphericity was used to determine if the 15 variables (i.e., quality management practices) were significantly correlated. When the variables are inter-correlated, the multivariate analysis of variance (MANOVA) should be used to maintain control over the experiment-wide type I error (Hair, Anderson, Tatham, and Black, 1992). The inter-correlation among the variables was significant at p=0.000, indicating that MANOVA was the appropriate method to use to compare the means across the groups.

Key assumptions that must be met when using MANOVA are independence of observations, homogeneity of variances, and normality of observations. Because the surveys were completed independently by each supplier within a two-month period, the observations can be assumed to be independent. The next assumption tested was homogeneity of variances. All the variables showed an equality of variance at a 1% level using Levene's test. Next, the assumption of normality of the dependent variables was checked. Because there is no indicator available to test multivariate normality, we tested the normality of the individual dependent variables. Only one scale, *design and introduction of products and services* (DSGN) failed to meet the normality assumption at a 1% level using the Kolmogorov-Smirov test. However, this violation should have a minimal impact on MANOVA results (Hair *et al.*, 1992).

In this study, multivariate analysis of variance was done using a general linear model (GLM-MANOVA). GLM-MANOVA is similar to the conventional MANOVA in terms of its assumptions and functionality but it can be used when, as is the case in this study, the groups being compared do not have the same number of cases (SPSS Advanced Statistics 7.5, 1997). The Wilks' lambda statistic indicated if there was a significant difference among the supplier groups considering all 15 dependent variables simultaneously. If a statistically significant difference among the groups was found, a multiple discriminant analysis (MDA) was performed to identify *which* specific variables contributed to the overall multivariate difference. Darden and Perreault (1975) demonstrated the advantages of using a multiple discriminant analysis in conjunction with MANOVA to help determine the intensity of each variable's contribution to the overall group differences. The assumptions for discriminant analysis are the same as those for MANOVA.

For discriminant analysis, we divided the entire data set randomly into two samples, an analysis sample, used to develop the discriminant function and a holdout sample, used to validate the discriminant function. This was done to avoid an upward bias in the prediction accuracy of the discriminant function (Hair *et al.*, 1992). We used a 75-25 split between the analysis (75% of total data) and holdout (25% of total data) samples that is adopted by some researchers (Hair *et al.*, 1992). In doing the discriminant analysis, we used a simultaneous method that considers all of the variables concurrently in the model.

4. Results

Scale means for the suppliers categorized by quality performance are shown in Table 4. GLM-MANOVA results showed that there is a statistically significant difference among low, medium, and high performing suppliers categorized according to quality performance (Wilks' lambda = 0.613, p = 0.004). Further analysis explored the sources of the group differences using MDA. Two canonical discriminant functions were extracted to discriminate between the low, medium, and high performing groups. Table 5 contains the results for the two canonical discriminant functions. The first function was statistically significant (p = 0.010) and the second function's significance was marginal (p = 0.056).

Table 4. Means of MBNQA Constructs by Quality Performance

Quality Management Practices	Quality Performance		
	Low Performer (n = 25)	**Medium Performer (n = 44)**	**High Performer (n = 52)**
LEXE	5.31	5.66	5.84
LSYS	4.29	4.80	4.74
LPUB	4.87	4.96	4.80
INFR	4.47	4.77	4.98
BNCH	4.46	4.68	4.82
ANAL	5.45	5.32	5.56
STDV	4.41	4.69	4.87
STDP	3.99	4.72	4.87
HPLN	3.90	4.63	4.63
HEMP	4.99	5.06	5.42
HEDU	4.67	4.97	5.28
HSAT	3.95	4.17	4.50
DSGN	4.75	4.68	4.98
PROS	4.63	4.83	5.37
SMGT	5.01	5.24	5.23

Table 5. Canonical Discriminant Functions

Function	Percentage of Variance	Canonical Correlation	Wilks' Lambda	Chi-Square	DF	Significance
1	54.9	.537	.534	50.8	30	0.010
2	45.1	.500	.750	23.3	14	0.056

Percent correctly classified (hit ratio)		
Overall Hit Ratio		**61.9%**
Analysis Sample		69.2
Holdout Sample	53.3	
Proportional Chance Criterion (C_{PRO})[1]	35.9	
Maximum Chance Criterion (C_{MAX})[2]		42.9

1. $C_{PRO} = p_1^2 + p_2^2 + p_3^2$ where p_1=proportion of suppliers in the low performing group (0.2066), p_2=proportion of suppliers in the medium performing group (0.3636), and p_3=proportion of suppliers in the high performing group (0.4297).
2. C_{MAX} = Largest group size / Total sample size.

Before interpreting the results of the discriminant analysis, the predictive validity of the discriminant functions were determined by comparing the overall hit ratio (61.9%) with the proportional chance criterion (C_{PRO}: 35.9%). The prediction accuracy of a discriminant function is acceptable if the classification accuracy reflected in the overall hit ratio is at least 25% higher than the C_{PRO} (i.e., 44.9% or more) (Hair *et al.*, 1992). Based on this criterion, both discriminant functions were valid and the hit ratios of the analysis (69.2%) and holdout (53.3%) samples outperformed the criterion.

Table 6. Summary of Interpretive Measures for Multiple Discriminant Analysis

	Rotated Discriminant Loadings[1]		Univariate F Ratio	Potency Index[2]
	Function 1[3]	Function 2[4]		
Senior Executive Leadership (LEXE)	.297	**.397***	3.11 (.05)[5]	0.119 (3)[6]
Leadership System (LSYS)	.092	**.429***	2.28 (.11)	0.088 (8)
Corporate Responsibility and Citizenship (LPUB)	-.064	.125	0.10 (.91)	0.009 (15)
Management of Information and Data (INFR)	.289	.219	1.97 (.14)	0.067 (9)
Benchmarking (BNCH)	.196	.106	0.73 (.49)	0.026 (13)
Analysis and Use of Data (ANAL)	.270	-.062	0.72 (.49)	0.041 (12)
Strategy Development (STDV)	.216	.221	1.68 (.19)	0.047 (10)
Strategy Deployment (STDP)	.173	**.445***	5.53 (.01)	0.106 (5)
Human Resource Planning and Evaluation (HPLN)	.215	**.476***	3.74 (.03)	0.127 (2)
Employee Empowerment (HEMP)	**.396***	.143	2.39 (.10)	0.095 (7)
Employee Education, Training and Development (HEDU)	**.341***	.228	2.89 (.06)	0.112 (4)
Employee Well-being and Satisfaction (HSAT)	**.390***	.219	2.42 (.09)	0.096 (6)
Design and Introduction of Products and Services (DSGN)	.275	-.042	0.82 (.44)	0.042 (11)
Process Management (PROS)	**.557***	.223	5.85 (.00)	0.193 (1)
Management of Supplier Performance (SMGT)	.004	.158	0.43 (.65)	0.011 (14)

Note: 1. A loading is the simple correlation between each variable and the discriminant function
2. Potency index is a relative measure among all variables indicative of their discriminant power
3. Function 1 discriminates high versus low and medium performing supplier groups
4. Function 2 discriminates high and medium versus low performing supplier groups
5. The numbers in the parentheses are the significance level of partial F-values
6. The numbers in the parentheses are the ranks of potency index values
* Larger correlation between each variable and discriminant functions

To interpret the results, the cumulative effects of the variables on the two significant canonical discrimination functions is indicated by the potency index as shown in Table 6. This index reflects both the contribution of a variable to a discriminant function and the relative contribution of the function to the overall solution (Hair *et al.*, 1992). The rank order of the potency index indicates that *process management* (PROS) had the strongest discriminant power, followed by *human resource planning* (HPLN), *senior executive leadership* (LEXE), *employee education and development* (HEDU), and *strategy deployment* (STDP). On the other hand, *corporate citizenship* (LPUB) showed the weakest discriminant power, followed by *supplier management* (SMGT), *benchmarking* (BNCH), *analysis and use of data* (ANAL), and *design and introduction of products/services* (DSGN).

A three-group discriminant analysis generates two canonical discriminant functions, making interpretation somewhat difficult. The entire solution was rotated with the varimax procedure for better interpretation. A graphical description of group centroids and discriminant functions is given in Figure 1. On this graph, the x-axis represents the discriminant function 1 and the y-axis represents discriminant function 2. Function 1 separates the high performing group from the medium and low performing groups. Function 2 separates the high and medium performing groups from the low performing group.

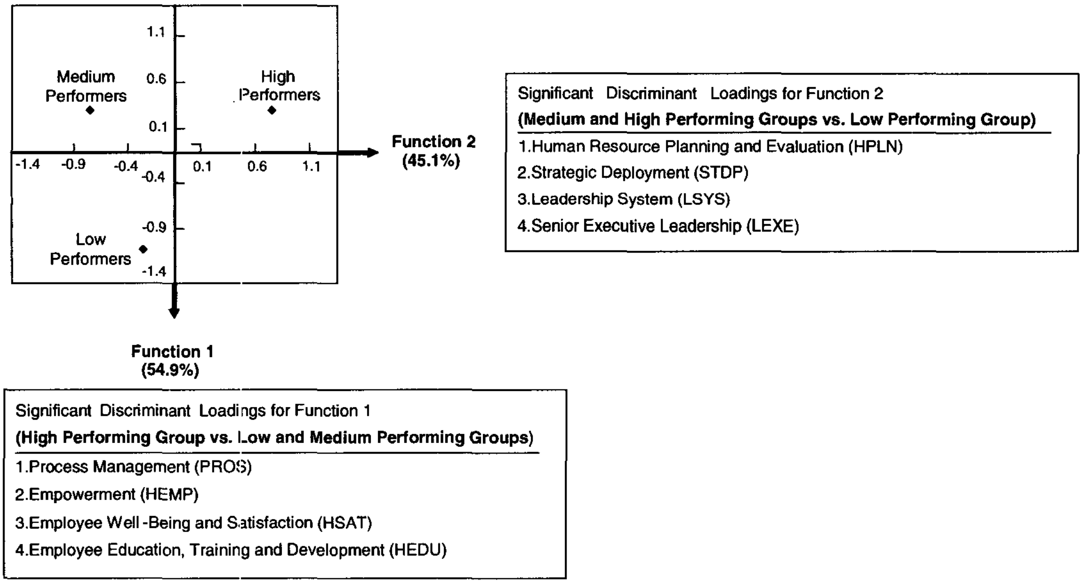

Figure 1. Graphical Description of Group Centroids by Performance

Rotated discriminant loadings increase our understanding of each variable's influence on group separation. The loadings measure the correlation between each variable and the discriminant function, reflecting the relative contribution of the variables to the discriminant function (Hair *et al.*, 1992). The rotated loadings corresponding to two discriminant functions are shown in Table 6. Variables exhibiting loadings ±0.30 or higher are considered to be statistically significant (Hair *et al.*, 1992). The loadings of *process management* (0.557), *empowerment* (0.396), *employee well-being and satisfaction* (0.390), and *employee education, training and development* (0.341) were significant in Function 1 suggesting that high performing group excels medium and low performing groups in these quality practices. The loadings of *human resource planning and evaluation* (0.476), *strategic deployment* (0.445), *leadership systems* (0.429), and *senior executive leadership* (0.397) were significant in Function 2 suggesting that high and medium performing groups excel low performing group in these quality practices.

5. Discussion

The results of MANOVA and MDA support the general contention that quality management practices improve quality performance. The emphasis on quality management practices was significantly different among the high, medium, and low performing supplier groups. Of the 15 quality management practices explored, *process management* was the best differentiator between the groups, followed by *human resource planning, senior executive leadership, employee education and training, strategic deployment, employee satisfaction*, and *employee empowerment.* Examination of the discriminant functions reveals that high performing group excels medium and low performing groups in *process management, employee empowerment, employee education and training, and employee satisfaction.* The practices that high and medium performing groups excel low performing group were *human resource planning and evaluation, strategic deployment, leadership system, and senior executive leadership.*

It is not surprising that *process management* is the most significant factor affecting quality performance. The process management construct in our study encompassed statistical process control, use of "fool-proof" systems, and continuous improvement through use of statistical techniques. Improving processes by reducing variation, using statistical process control, and engaging in continuous improvement activities addresses and eliminates the root causes of problems thus can increase quality performance.

All the variables (i.e., *human resource planning, employee education and training, employee satisfaction,* and *employee empowerment*) associated with human resource management contributed significantly to the differences among the supplier groups. This further supports the importance of employees to quality performance (Lawler, Mohrman, and Ledford Jr., 1992; Ahire and O'Shaughnessy, 1998; Choi and Eboch, 1998; Forker, 1997). It appears that how people are managed can really make a difference in quality performance.

Strategic deployment differentiated the low performers from the medium and high groups for quality performance. Although, some studies found a relationship between strategic planning and customer satisfaction (Choi and Eboch, 1998; Handfield and Ghosh, 1995), a relationship between strategic deployment and quality performance has not been reported in previous studies. Cormier (1994) proposed that strategy deployment is as a means of ensuring successful company-wide adoption of management systems like just-in-time (JIT) and TQM. The importance of effective strategy deployment is supported by the results of Forker's (1997) study that suggested that effective implementation is key to obtaining measurable improvements in quality performance. From a practical viewpoint, effective implementation of plans would seem to be an important factor affecting performance. That is, great plans cannot increase quality performance unless the plans are effectively deployed.

The results of MDA suggest that *employee empowerment, employee education and training,* and *employee satisfaction* along with *process management* significantly contribute to differentiating the high from the medium and low performers. Some aspects these factors such as employee empowerment and satisfaction are intangible and will be difficult for a buyer to evaluate both during the supplier selection process and during on-going working relationships. However, these capabilities may enable suppliers to form the foundation for a long-run competitive advantage for their buyers.

The MDA results further suggest that s*trategic deployment, leadership system, senior executive leadership,* and *human resource planning and evaluation* differentiate high and medium performers from low performers. Three of the factors, s*trategic deployment, leadership system, senior executive leadership* are likely to be related to the commitment of top management to a particular strategy for quality improvement. *Human resource planning and evaluation* is closely associated with top management's strategic decisions because human resource plan and development must be aligned with a firm's strategy and objectives. One of the key factors in TQM adoption is the development of a quality culture that respects the potential contribution of quality attitudes, employee involvement, and continuous improvement (Hackman and Wageman, 1995). The organizational culture can be changed or created by the strategic leadership provided by top management (Hill and Jones, 1995). The results of this study suggest that top management's effort to create a quality culture through strong commitment will improve a supplier's quality performance. However, top management's strategic commitment is not enough to move a supplier from a medium to a high performer. Effective process management and human resource management must be built into the organization to be a high performer, consistent with the notion that TQM starts at the top, but needs support from the lower levels.

The quality practices that showed a relatively weak impact on discrimination between the groups were *corporate citizenship* and *supplier management.* It is not surprising that corporate citizenship encompassing a firm's environmental concern and public responsibilities was not major factor differentiating groups based on quality performance. However, the fact that supply management was not a significant discriminator among the groups was unexpected. For instance, Ahire and O'Shaughnessy (1998) found supply management to be related to product quality. In addition, many US companies work closely with their suppliers to the supplier's improve performance and capabilities (Krause, 1997, Watts and Hahn, 1993). One possible explanation, supported by the relatively high mean values for all three groups, is that supplier management may be an order qualifier required to survive in the automotive industry rather than an order winner needed to be a high performer. Security of raw materials from the suppliers was a long-standing problem because of a large number of labor disputes during the last few decades in the Korean automotive industry (Chow, Holbert, Kelley, and Yu, 1997). Thus, a good relationship with the raw material suppliers through supplier management was a key to survive in the market.

6. Conclusions and Limitation

So, based on the results of this study, which quality management practices should companies emphasize to improve their quality performance. Process management techniques, effective human resource management, and top management's strategic commitment are likely to be the most important, at least in the Korean automotive industry. The findings also suggest that top management's strong commitment to quality is necessary but not sufficient for high quality performance. Effective process management and employee involvement including employee empowerment, satisfaction, and education and training must support the top management's strategic commitment. However, further research is needed to determine if there are hierarchical relationships between human resource practices and leadership practices that could affect quality performance. For instance, certain practices such as leadership are likely to be the foundation for other practices such as human resource management. Future studies should use a longitudinal approach to explore how supplier's practices and performance evolve over time. The results would provide guidance to buyers doing supplier development in terms of the order in which to implement practices with their suppliers.

The results may be startlingly interesting to the strategy scholars in highlighting the importance of strategy implementation. Results imply that process management and employee satisfaction matter greatly more than what the strategy scholars have been emphasizing. It is interesting to note that strategy planning and top management's leadership does matter, but not to the extent that the strategy field has been focusing. The findings can be construed to help academics as well as practitioners in identifying areas to administer first-aid to companies in dire circumstances, as well as further improving companies to reach top-performing status. Most of all, the results may pave way for more concrete studies in the field of strategy.

This study used the MBNQA criteria to measure quality management practices. Although the MBNQA criteria comprehensively include quality management practices in many aspects, they were developed specifically for US companies. Some practices in the MBNQA may not be congruent with quality management practices of Korean companies. However one contribution of this study is that it tested the validity of MBNQA criteria use for the Korean automotive industry. Recently, major US big three showed their interests to expand the business in the Asian market (Coleman, 1998). Thus, the results of this study may provide a guideline for the quality management in the Asian market.

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