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A Theoretical Framework for Exploring the Effect of the Six Sigma Management Activities on Corporate Competitiveness

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ABSTRACT

Six Sigma has long been used as an effective way to restructure a company's management process. While there are abundant case study literatures on Six Sigma, a theoretical framework that can logically advance the previous work into a higher level is lacked. What's more, there are few empirical studies to verify those results from previous case studies. To fill these two gaps, this study proposes a comprehensive theoretical research framework of Six Sigma-based management activities, build up a research model of its effectiveness, and further verifies its effect in improving corporate competitiveness through empirical data analysis based on valid questionnaires collected from managers in Samsung companies that have been applying Six Sigma for several years. Empirical results from Structural Equation Modeling method showed that the proposed theoretical research model of Six Sigma activities is indeed effective in refreshing process management, improving quality, and, finally, improving corporate competitiveness.

Keywords

Six Sigma management activities, corporate competitiveness, business process change management, TQM.

INTRODUCTION

Six Sigma is a rigorous and systematic methodology that utilizes information (management by facts) and statistical analysis to measure and improve a company's operational performance, practices, and systems by identifying and preventing 'defects' in manufacturing and service-related processes in order to anticipate and exceed expectations of all stakeholders (Byrne 2003; Islam 2004; Pande et al. 2000; Rowlands 2003; Weiner 2004). As a business process management tool, Six Sigma rely highly on the transparency and accuracy of information to simplify the business process and help manager's to make better decisions systematically in a complicated marketplace. Since IS has been closely integrated into the business process improvement through designing information systems to support the business units, it's role in Six Sigma can't be ignorable (Tiwari et al. 2008). Hence it's very desirable to design decision support systems (DSS) for the effective implementation of Six Sigma methodology to tackle complex problems in the real business world.

However, the academic community has lagged in its understanding of Six Sigma activities (Linderman et al. 2003) and there is presently no theoretical framework to guide a company in implementing Six Sigma in a way leading to improvement of corporate performance. Given the fact that less than ten percent of companies adopting Six Sigma actually achieved the originally targeted objectives, finding the critical factors that influence the success of Six Sigma implementation is essential to the IS field as well as the industry (Coronado et al. 2002). Literature review shows that previous studies on Six Sigma business activities were mostly case studies, thus suggesting developing a rigorously proved theoretical framework for effective Six Sigma implementation. To fill this research gap in the Six Sigma literature, this study tries to: 1) propose a rigorous theoretical framework including both the management practices influencing implementation and the effect of Six Sigma management activities on corporate competitiveness; 2) propose a research model including effective management practices influencing successful Six Sigma implementation; 3) suggest proper management practices that make Six Sigma management activities effective; 4) empirically analyze the effects of Six Sigma management activities on corporate competitiveness through Structural Equation Modeling (SEM) and 5) provide practical guidelines for successful implementation of Six Sigma Management Activities based on the results of the empirical analysis.

PREVIOUS RESEARCH

The previous literature about the Six Sigma can be categorized into four groups. The first category is related with the fundamental concept of how to implement the Six Sigma in organizations (Blakeslee Jr. 1999; Does et al. 2002; Elliott 2003; Goh 2002; Hahn et al. 1999; Islam 2004; Rowlands 2003). Most of the Six Sigma studies belong to this category and there is no theoretical foundation in this area. The second category is the case studies addressing how the Six Sigma activities were successful in certain management contexts (Frank 2003; Gale 2003; Heuring 2004; Wyper et al. 2000) and often both theoretical analysis and empirical analysis are omitted. The third category is to investigate the success management practices of the Six Sigma management (Antony et al. 2002; Coronado et al. 2002) and some theoretical factors begin to emerge. The fourth category is very rare but aims to develop a theoretical framework and verify it empirically (Lee et al. 2006). The first three categories heavily rely on the descriptive analysis without relevant or clear research model. Therefore, the fourth category should be explored. This study will Aims at enrich and explore the current literature in the fourth category to fill the research gap of lacking enough empirical studies and solid research framework. The following section thus reviews management practices that may build up our research framework from four perspectives, Six Sigma management activities, process innovation, quality improvement and corporate competitiveness, all of which are based on the previous literature.

Six Sigma Management Activities

As reviewed in the literature, the effects of Six Sigma management have been reported only in various case studies (Heuring 2004; Jones 2004; Weiner 2004). However, a theoretical model with concrete analysis of what management practices directly or indirectly influenced Six Sigma management is lacking. The detailed analysis of the Six Sigma management activities is also limited. In this study, we use management practices from previous literature to first measure Six Sigma management activities with complete but concise management practices, then further test these activities' effect on the performance measures of the company's 'Process Innovation,' 'Quality Improvement,' and 'Improvement in Corporate Competitiveness.' In this study, we used Information Utilization, Standardization, Promotion, CEO's Will, Communication, Training, and Policy to measure Six Sigma management activities (Ahire et al. 1996; Benson et al. 1991; Hahn et al. 1999; Joseph et al. 1999; Saraph et al. 1989). A complete explanation of the management practices to measure Six Sigma management activities together with its source is presented in Table 1 below.

Measuring Factor	Main Substance	Source
Information Utilization	Systematic management process of information and data resource in order to apply six sigma	(Ashmore 1992; Bender 1986; Hackman et al. 1995; Joseph et al. 1999; Saraph et al. 1989)
Standardization	Standardization and index management to minimize the variation during implementation of six sigma management activities.	(Blakeslee Jr. 1999; Breyfogle et al. 2001; Joseph et al. 1999; Roberts 2004)
Promotion	Sustaining management to results of six sigma management activities and promotion activities for spreading throughout the organization	(Benson et al. 1991; Gale 2003; Heuring 2004; Jones 2004)
CEO's Will	The management level's will to propel six sigma management activities and supports for six sigma	(Benson et al. 1991; Blakeslee Jr. 1999; Breyfogle et al. 2001; Hahn et al. 1999; Joseph et al. 1999; Lau et al. 1998; Saraph et al. 1989)
Communication	Every activity developed to inform all members and share the concept of six sigma management activities	(Berkley et al. 1995; Gale 2003; Hackman et al. 1995; Saad et al. 2000; Samuels et al. 2003)
Training	Learning activities in organizational levels for sustainable application of six sigma activity	(Ettinger et al. 2003; Gale 2003; Heuring 2004; Jones 2004)
Policy	Organizational support and strategy for sustainable promotion of six sigma management activities	(Benson et al. 1991; Blakeslee Jr. 1999; Hackman et al. 1995; Hahn et al. 1999; Heuring 2004; Joseph et al. 1999; Rowlands 2003)

Table 1. Management Practices for Measuring Six Sigma Management Activities

Process Innovation and Six Sigma

One important method of measuring the effectiveness of Six Sigma is to see the change of the business processes, which are fundamental components of most of the work executed by companies. A process is an activity that adds value to inputs and

provides outputs to internal/external customers (Harry et al. 2000). Six Sigma innovation strategies set improvement goals for every process in the organization and let the organization adopt the latest technology. This form of Six Sigma management is known as a very effective method for process improvement in many industries (Ettinger et al. 2003).

Quality Improvement

Another important measure of effectiveness of Six Sigma is the quality improvement because the Six Sigma, a quality improvement methodology based on statistics, is the latest method in a progression of integrated quality plan series, such as Quality Circle, TQM, Team Concept, and ISO9000 (Gluckman 2003). One of the characteristics of Six Sigma management is that it exposes the previously invisible COPQ (Cost Of Poor Quality). The main goal of Six Sigma is to develop a clear understanding of CTQ (Critical To Quality) and to allocate resources accordingly. Previous studies have showed that Six Sigma can fulfill its role in improving the quality (1999; Jones 2004), which suggests the need to eliminate waste factors by accomplishing a nearly perfect quality level and this is one of the goals of Six Sigma (Biolos 2002; Weiner 2004).

Company Competitiveness

Another important concept to measure the performance of the companies is company competitiveness, which has been used to measure the change of the company in previous TQM studies (Flynn et al. 1995). Since Six Sigma has been determined as a quality improvement method, it is supposed to contribute to the rapid improvement of quality and competitiveness (Blakeslee Jr. 1999). Harry and Schroeder (2000) also mentioned that the main reason for adopting Six Sigma management is to increase profits.

Generally, the competitiveness of companies can be determined through various indices and standards. In the past, company size was used as the main index of competitiveness, but nowadays qualitative measures such as profitability are considered over quantitative measures such as externals. In practical business affairs, the organizational performance of Six Sigma management is proposed via two aspects: financial outcomes, including economic effects, and non-profit performance, such as employee satisfaction. Most companies wish to measure the financial performance of Six Sigma by using ROI (Return On Investment), which considers the collected value to the invested. Yet, it is practically inaccurate to measure results with this method. In this study, therefore, we measured corporate competitiveness by surveying the degree of contribution made to business by Six Sigma, and we investigated whether financial outcomes can be expected continuously in the future.

RESEARCH HYPOTHESIS AND RESEARCH MODEL

The objective of this section is to propose a research framework that can guide the practitioners to implement Six Sigma successfully. To achieve this, we first propose a research framework showing the sequential phases through which certain management innovative activities would improve the corporate performance. Then, a detailed research model based on the research framework was proposed from which the research hypotheses are developed to verify the influence of the Six Sigma management activities on the corporate competitiveness empirically.

Proposed Theoretical Framework

The Six Sigma is a relatively new management innovation method, indicating that it is necessary for us to refer to other previous methods like Business Process Reengineering (BPR) and TQM before constructing the research model for the relationships between Six Sigma and corporate performance. Literature on management innovation methods such as BPR, TQM, and Six Sigma showed that, management innovation methods would lead to significant improvement of the corporate performance when the fundamental infrastructure for management innovation is established within the company, and the corresponding innovative activities are consistently made on the basis of the infrastructure (Flynn et al. 1995; Kettinger et al. 1995; Kettinger et al. 1997).

The previous management innovation literature first clearly revealed that the management innovative activity should be firmly based on the fundamental infrastructure and facilitated by it (Flynn et al. 1995; Kettinger et al. 1997). Secondly, an appropriate form of management activity should be performed as a next step.

Similarly, we proposed the Six Sigma implementation theoretical framework in a nutshell showing how a management innovative activity would affect the corporate performance. It composes of a chain of sequential positive effect starting from fundamental infrastructure, operational structure, strategic activities, to performance. Figure 1 depicts the proposed theoretical framework.

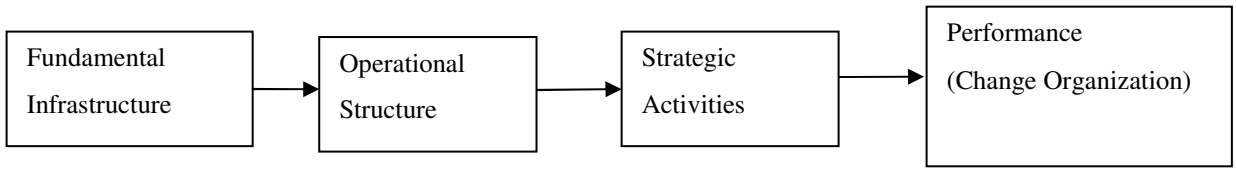

Figure 1. Proposed Theoretical Framework

PROPOSED RESEARCH MODEL AND HYPOTHESES

To test the robustness of the proposed theoretical framework in Figure 1, we propose a research model together with research hypotheses specifying the valid relationship between Six Sigma management activities and corporate competitiveness. Following the research framework, the research model consists of four sections, the fundamental management activities parallel the fundamental infrastructure, and substantial management activities parallel the operational structure, the strategic activities, and performance. The proposed research model is presented in Figure 2 and the hypotheses are developed from this model as follows.

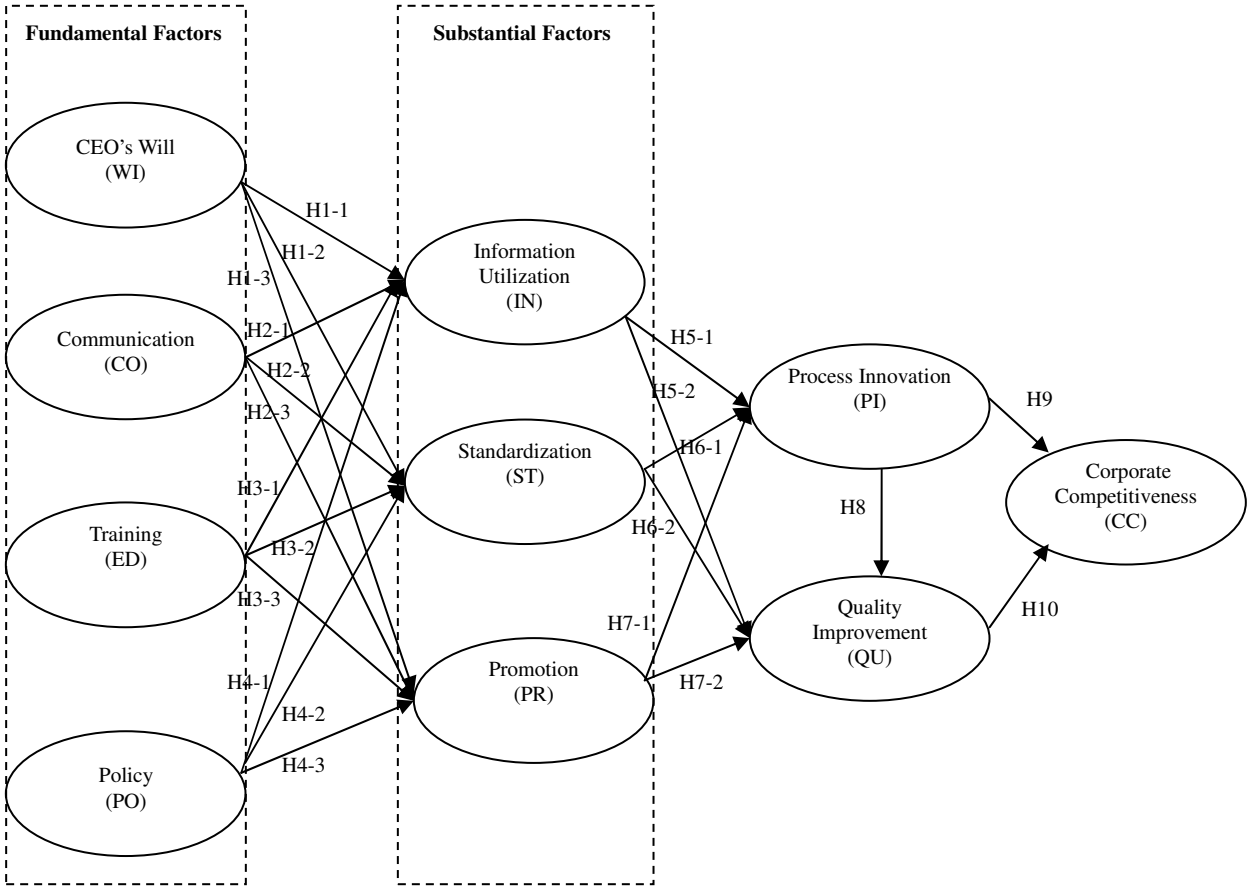

Figure 2. Proposed Hypotheses

Fundamental and Substantial Management Practices

Six Sigma management activities demand organizational to change its way of working and business processes to form a culture for members to accept the change it brings(Blakeslee Jr. 1999). Establishment of a preliminary infrastructure is

essential for smooth Six Sigma management implementation. After the infrastructure is prepared, the actual Six Sigma management activity is conducted through Six Sigma projects or operational management practices such as information utilization, standardization, and promotion (Does et al. 2002). To solve the organization's problems, systemically educated/trained driving forces should be deployed to execute projects. The projects are selected according to how well they match the organization's strategy and direction (Rowlands 2003). Information utilizations and standardization are very useful for smooth progress during the process of setting up the infrastructure for Six Sigma management activities is (Breyfogle et al. 2001; Hackman et al. 1995). Once the initial Six Sigma project implementation finished, reinforcement of promotion for Six Sigma results is required for dissemination. In most organizations, top management participates actively in the result promotion activities for successful implementation of Six Sigma management activities (Gale 2003; Heuring 2004).

Therefore, in this study, we have set the following hypotheses to determine if preliminary infrastructural management practices and Policy have valid effects on operational management practices:

Hypothesis H1-1/2/3: The CEO's Will will exert positive effects on systematical information management, standardization and objective index management, and improvement reflection and promotion under Six Sigma management activities.

Hypothesis H2-1/2/3: Fluent communication will exert positive effects on systematical information management, standardization and objective index management, and improvement reflection and promotion under Six Sigma management activities.

Hypothesis H3-1/2/3: Training will exert positive effects on systematic information management, standardization and objective index management, and improvement reflection and promotion under Six Sigma management activities.

Hypothesis H4-1/2/3: Policy will exert positive effects on systematic information management, standardization and objective index management, and improvement reflection and promotion under Six Sigma management activities.

Substantial Management Practices and Strategic Activities

The effect of process innovation and quality improvement can be achieved by implementing the operational management practices through Six Sigma activities. Six Sigma management activities can obtain variation minimization through process standardization. Six Sigma provides common language for sustaining process improvement (Blakeslee Jr. 1999). As Six Sigma management activities provide sustained monitoring of the maintenance of improvements and sustainable assessment of the core process, maintaining a fixed level of quality is also possible (Jones 2004). Therefore, we have set the following hypotheses:

Hypothesis H5-1/2: Systematic information management will exert positive effects on corporate process innovation and corporate quality improvement, under Six Sigma management activities.

Hypothesis H6-1/2: Standardization and objective index management will exert positive effects on corporate process innovation and corporate quality improvement, under Six Sigma management activities.

Hypothesis H7-1/2: Improvement reflection and promotion will exert positive effects on corporate process innovation and corporate quality improvement, under Six Sigma management activities.

Strategic Activities and Performance

A series of Six Sigma activities would finally lead to the performance change of the organization. Conventionally, a variety of quality management methodologies have been introduced: for instance, TQM and Quality Circle for gradual improvements and Six Sigma and Reengineering for radical improvements (Benedetto et al. 2003). In innovative methods such as Six Sigma and Reengineering, it is generally understood that the process is the core factor in determining quality. As Six Sigma requires companies to understand the requirements of their customers, it is important for companies to focus on external activities even while they focus on internal process improvements. Through these activities, companies can make rapid progress in quality and competitiveness (Blakeslee Jr. 1999). In conclusion, Six Sigma management activities affect process innovation and quality improvement, resulting improved competitiveness. Hence, the following hypotheses are postulated:

Hypothesis H8: Corporate process innovation obtained through Six Sigma management activities will exert positive effects on quality improvement.

Hypothesis H9: Corporate process innovation obtained through Six Sigma management activities will exert positive effects on reinforcing corporate competitiveness.

Hypothesis H10: Corporate quality improvements obtained through Six Sigma management activities will exert positive effects on reinforcing corporate competitiveness

RESEARCH METHODOLOGY

Data for testing the research model was collected through a survey from Samsung's companies. Those companies who have been implementing Six Sigma for several years were contacted to collect data. SEM with Lisrel 8.70 was used to analyze the data.

Sampling and Data Collection Process

Fifteen representative companies in Samsung's manufacturing (9 companies), service (4 companies), and financing (2 companies) divisions, which have been implementing Six Sigma for several years (below 3 years: 2 companies, 3~5 years: 10 companies, above 5 years: 3 companies) haven been chosen as sample for this study. 350 questionnaires were distributed to Six Sigma management personnel working in those fifteen companies. The questionnaires were directly sent to the corresponding company's Six Sigma managers by e-mail or hard copy, encouragement to fill out the survey were made by phone three days later; the total process took about two weeks. Three hundred thirty-three valid questionnaires were collected for analysis, resulting in a response rate of 95%. The main respondents were Samsung employees who had finished Six Sigma education programs, had been working in the field for several years, and had MBB (Master Black Belt) or BB qualifications, two terms used to describe the degree of proficiency of statistical tools and expertise in leading and teaching others the Six Sigma projects.

Operational Definition of Measurement and Measurement Validation

The measurement in this study was operationalized according to the measurement adapted literature reviewed in the literature section. To ensure the validity and reliability of the questionnaire, a three-stage survey validation was conducted. First, whenever possible, the questions were prepared initially on the basis of operational definitions based on previously validated questions whenever possible. Second, the instruments originally in English were back-translated from English into Korean by bi-lingual (Korean and English) authors. Translation equivalence from English to Korean language was in this way accomplished in line with other cross-cultural research (Mullen 1995). Third, a pilot test was conducted with 52 managers responsible for Six Sigma activities in the Samsung Corporation.

Data Analysis

Structural Equation Modeling (SEM) was conducted to validate and test the research model proposed. SPSS 14.0 and Lisrel 8.70 were used to analyze all data collected. The reliability of Cronbach's Alpha is presented together with CFA to check further level reliability, validity, and goodness-of-fit indices for the research model. CFA was used to check the fitness of data for our research model.

DATA ANALYSIS RESULTS

Analysis of Measurement and Structural Model

Lisrel 8.70 was used to analyze the research model in this study. A two step approach—measurement model and structural model analysis—was employed based on the recommendation of Anderson and Gerbing (1988). A CFA using LISREL 8.70 was conducted to test the measurement model.

Scale reliability and validity were assessed with CFA and Cronbach's Alpha. The CFA approach was employed in this study not only because most measurements has been validated in previous studies but also because CFA can provide the overall goodness of fit for the proposed measurement. The CFA validation was evaluated from the Goodness of fit index, the reliability analysis, and the validity perspective. The goodness of fit indices for the measurement model suggests that the model has a good fit (χ^2/df =2.16 (1259.98/584), RMSR=0.05, GFI=0.82, AGFI=0.78, NFI=0.97, NNFI=0.98, IFI=0.98, CFI=0.98, RMSEA=0.06) (Hu et al. 1999).

The measurement model was further assessed for the construct reliability and construct validity. Construct reliability was accessed at three levels--Cronbach's Alpha, item reliability, and composite reliability. Based on the test result, all item reliabilities surpassed the 0.50 and showed an acceptable level of item reliability. The composite reliabilities also demonstrate acceptable values above the threshold of 0.70 suggested by Fornell and Larcker (1981).

Convergent validity can be assessed by examining the factor loading of the constructs and the average variance extracted (AVE). All the factor loadings in this study are greater than 0.70 and the AVE of all the constructs is greater than 0.50 and showed a significant convergent validity. The discriminant validity can be assessed by comparing the shared variance among constructs with the average variance extracted. Our results show that all average variances extracted are above 0.50, which surpasses the minimum recommended value.

Analysis Results of the Structural Model

Using the sample covariance matrix, the research model was examined with Lisrel 8.70 in terms of overall goodness of fit and the overall explanatory power. The model testing result was summarized in Figure 3. The explanatory power of the structural model was assessed in terms of the portion of variance explained. As shown in Figure 3, 30% variance of corporate competitiveness, 30% variance of process innovation, and 50% variance of quality improvement were explained by the research model.

The significance of hypotheses and the relative strength of individual path are reported in Figure 2 too. As shown, eleven of twenty one postulated paths were found to be significant at the respective 0.01 or 0.001 level. A detailed summary of the supported and non-supported hypotheses was presented in Table 2.

The strength of each individual path was evaluated by the standardized path coefficients, ranging from -1 to +1 in Figure 3. Table 3 summarized both the direct and indirect effects of the respective factor on process innovation, quality improvement, and corporate competitiveness Overall, the corporate competitiveness is influenced by fundamental factors such as CEO's will (0.10), communication (0.37), and training (0.18), substantial factors such as promotion (0.54), and process innovation (0.38) and quality improvement (0.58). Process innovation exerted a very strong effect on quality improvement (0.76) thus a strong indirect effect on corporate competitiveness (0.44) through quality improvement.

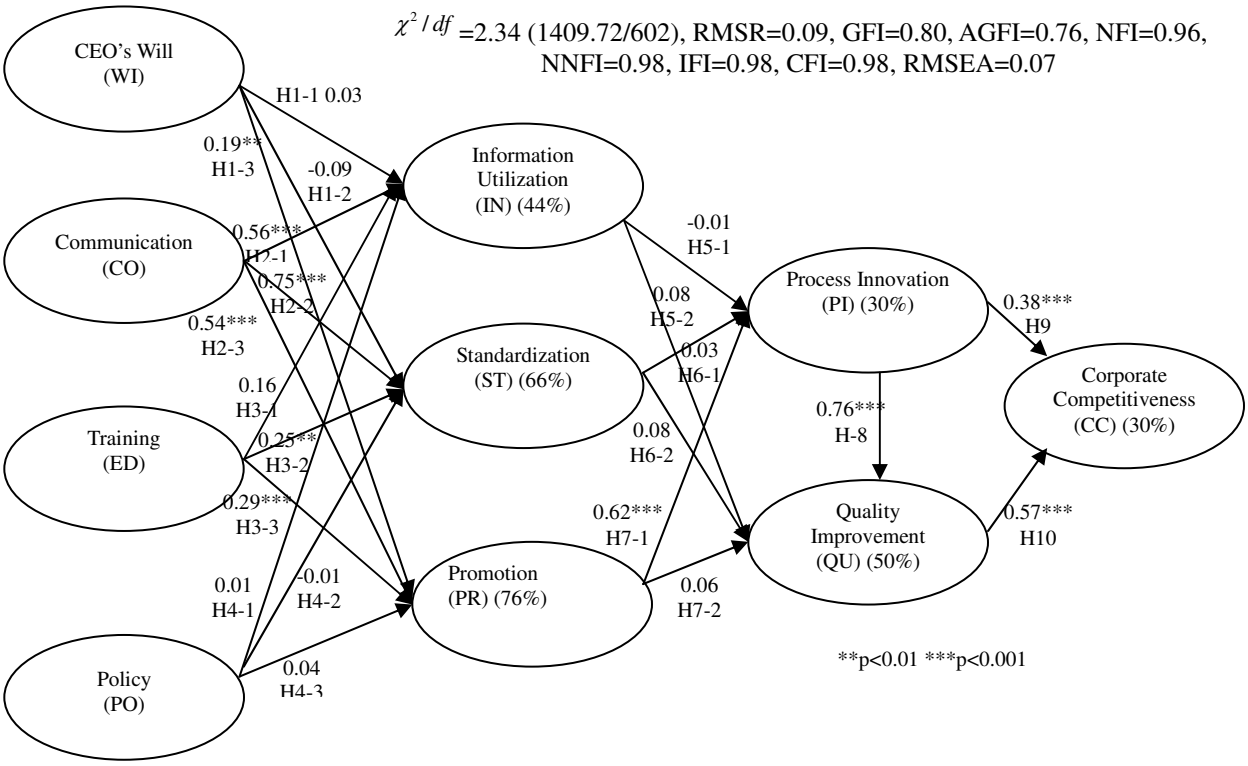

Figure 3. Model Testing Result

Hypothesis	Path	Path Coefficient	Acceptance/ Rejection
H1-1	CEO's Will → Systematical Information Management	0.03	Rejected
H1-2	CEO's Will → Standardization	-0.09	Rejected
H1-3	CEO's Will → Promotion	0.19*	Accepted
H2-1	Fluent Communication → Systematical Information Management	0.56***	Accepted
H2-2	Fluent Communication → Standardization	0.75***	Accepted
H2-3	Fluent Communication → Promotion	0.54***	Accepted
H3-1	Sustaining Training → Systematical Information Management	0.16	Rejected
H3-2	Sustaining Training → Standardization	0.25**	Accepted
H3-3	Sustaining Training → Promotion	0.29***	Accepted
H4-1	Policy → Systematical Information Management	0.01	Rejected
H4-2	Policy → Standardization	-0.01	Rejected
H4-3	Policy → Promotion	0.04	Rejected
H5-1	Systematical Information Management → Process Innovation	-0.01	Rejected
H5-2	Systematical Information Management → Quality Improvement	0.08	Rejected
H6-1	Standardization → Process Innovation	0.03	Rejected
H6-2	Standardization → Quality Improvement	0.08	Rejected
H7-1	Promotion → Process Innovation	0.62***	Accepted
H7-2	Promotion → Quality Improvement	0.06	Rejected
H8	Process Innovation → Quality Improvement	0.76***	Accepted
H9	Process Innovation → Corporate Competitiveness	0.38***	Accepted
H10	Quality Improvement → Corporate Competitiveness	0.58***	Accepted

Table 2. Hypothesis Testing Results

Effects on Process Innovation		Effects on Quality Improvement		Effects on Corporate Competitiveness	
Direct effect	Effect Size	Direct effect	Effect Size	Direct effect	Effect Size
		Process Innovation	0.76	Process Innovation	0.38
		Information Utilization	0.07	Quality Improvement	0.58
Standardization	0.03	Standardization	0.10		
Promotion	0.62	Promotion	0.53		
Indirect effect		Indirect effect		Indirect effect	
CEO's Will	0.11	CEO's Will	0.09	CEO's Will	0.10
Communication	0.35	Communication	0.40	Communication	0.37
Training	0.18	Training	0.19	Training	0.18
Policy	0.03	Policy	0.02	Policy	0.02
				Information Utilization	0.03
				Standardization	0.07
				Promotion	0.54
				Process Innovation	0.44
Total Effect		Total Effect		Total Effect	
CEO's Will	0.11	CEO's Will	0.09	CEO's Will	0.10
Communication	0.35	Communication	0.40	Communication	0.37
Training	0.18	Training	0.19	Training	0.18
Policy	0.03	Policy	0.02	Policy	0.02
Information Utilization	-0.01	Process Innovation	0.76	Information Utilization	0.03
Standardization	0.03	Information Utilization	0.07	Standardization	0.07
Promotion	0.62	Standardization	0.10	Promotion	0.54
		Promotion	0.53	Process Innovation	0.82
				Quality Improvement	0.58

Table 3. Strength of Individual Factor

DISCUSSIONS

This paper tries to build up a theoretical framework through classifying various Six Sigma activities into the fundamental activities and substantial activities. 21 hypotheses were developed and 11 of them are supported. Based on the hypothesis testing results, the following strategic meaning can be drawn.

First, the fundamental management practices such as CEO's Will, Communication, Training, exert a positive effect on the substantial management practices like Information Utilization, Standardization, and Promotion. In addition, the substantial management practices have a positive relationship with process innovation, which in turn affects the company competitiveness eventually. This finding supports the logical validity of the proposed theoretical framework. Through the previous empirical analysis, we concluded that the four fundamental management practices as well as three substantial management practices are meaningful activities influencing the success of the Six Sigma management significantly. Second, the CEO's Will has been analyzed such that three management practices related to actual implementation of Six Sigma don't affect systematic information management and standardization; on the other hand, the CEO's Will exerts a positive effect on promotion. Third, it can be seen that the three management practices related to actual implementation of Six Sigma exert positive effects on process innovation. Many companies, especially leading global companies, realize that dramatic results can be created through implementing Six Sigma methodology for process innovation. This is because Six Sigma requires

companies to measure and analyze business processes (Blakeslee Jr. 1999). The concept of variance between expected performance and actual implementation results is located at the heart of the Six Sigma management (Harry et al. 2000; Pande et al. 2000). Fourth, though it can be seen that the three management practices related to the actual implementation of Six Sigma exert positive effects on process innovation, there is no effect on quality improvement. This is consistent with the concept that Six Sigma management activities consider the process (Harry 1998). Fifth, process innovation has statistically significant effects on quality improvement, which leads to positive effects on the improvement of corporate competitiveness. This is explained as Six Sigma management activities bring precedent process innovation and affect quality improvement, finally leading to corporate competitiveness.

CONCLUDING REMARKS

In this study, through a rigorous survey of Six Sigma-related operations, we have tried to verify how Six Sigma management activities influence the improvement of corporate competitiveness. For this purpose, we first proposed a theoretical framework for proving the effect of Six Sigma management activities on the corporate competitiveness, on the basis of methodological metaphors of similar management innovation approaches such as BPR, TQM, and BPC. Then a research model was proposed in which a set of the valid relationships among the relevant variables are hypothesized. For the sake of empirical analyses, we determined seven constructs for measuring Six Sigma management activities: Information Utilization, Standardization, Promotion, CEO's Will, Communication, Training, and Policy.

Six Sigma management activities were classified in two categories: the preliminary preparation activities (CEO's Will, Communication, Training, Policy) and substantial Six Sigma activities (Information Utilization, Standardization, Promotion), and the effect of preliminary preparation activities on substantial Six Sigma management activities was empirically analyzed. The causal relations were confirmed through analysis results. These constructs were used to confirm that Six Sigma management activities exert positive effects on corporate competitiveness, firstly through process innovation, which in turn leads to quality improvement. This shows results identical to the preliminary research carried out by Lee and Choi (2006).

This research has limits since the survey was confined to the affiliated companies of Samsung. Therefore, this research should extend its pool of subjects under analysis to various classes hereafter, to generalize the empirical results.

Further research issues remain as follows. First, a sophisticated framework for diagnosing hidden problems and evaluating the level of the Six Sigma management is needed. Second, the research model needs to be advanced into considering specific characteristics about the industry to which the target companies belong. Third, longitudinal studies should be performed to analyze the difference of the Six Sigma management performance along the time from introductory stage to mature stage.

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