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Research on the Correlation between Implementation Strategies of TQM, Organizational Culture, TQM Activities and Operational Performance in High-Tech Firms

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Abstract: This study probes into the influences of implementation strategies of Total Quality Management (TQM) and organizational culture on execution degree of TQM activities and the effect of execution degree of TQM activities on operational performance. The subjects of this research were Taiwan's high-tech firms in the Hsinchu Science-Based Industrial Park and Southern Taiwan Science-Based Industrial Park. Quality management supervisors in the companies were the target respondents. The design of the questionnaire items was based on literature review. The research findings reveal that implementation strategies of TQM (cost leadership strategy and differentiation strategy) have significant influence on the execution degree of TQM activities; Organizational culture significantly influences execution degree of TQM activities; TQM activities execution degree significantly influences operational performance (quality performance, financial performance and inventory management performance). When reinforcing the operational performance, the firms should first enhance the execution of TQM activities. In order to significantly enhance execution degree of TQM activities, the firms can improve the implementation of cost leadership and differentiation strategy and combine the characteristics of four cultures (group culture, developmental culture, hierarchical culture and rational culture).

Key words: Cost leadership, differentiation, organizational culture, TQM activities, operational performance

INTRODUCTION

The empirical researches on the implementation of TQM activities (Salaheldin, 2003; Levin and Shortell, 2006; Kaynak, 2003; Bhanugopan, 2002; Quek and Yusof, 2003; Agus and Abdullah, 2000a; Hendricks and Singhal, 2001; Terziovski and Samson, 2000; Flynn *et al*., 1995; Tamimi, 1995; Mosadegh Rad, 2006) focus on the related factors, the application of TQM activities in the industry and the influence on operational performance. However, few empirical studies have incorporated the concepts of implementation strategies of TQM and organizational culture into TQM activities in the examination of its influence on operational performance. This study probes into the influences of implementation strategies of TQM and organizational culture on TQM execution degree and the effect of TQM execution degree on operational performance. The research purposes are: (1) to study the influence of implementation strategies of TQM on execution degree of TQM activities; (2) to study the influence of organizational culture on execution degree of TQM activities; (3) to study the influence of execution degree of TQM activities on operational performance and (4) to explore the execution degree of TQM activities of firms with different characteristics on operational performance.

Jeffries *et al*. (1996) suggested that TQM refers to overall organizational management to satisfy the customers' needs and continuously improve the organizational activities. Based on literature review, Seetharaman *et al*. (2006) generalized 6 key success factors on the execution of TQM activities: high-rank managers' support, employees' active involvement in the implementation, methods to measure the performance, culture of continuous improvement, value on customers' needs, education and employee training. By keywords searching, Ismail and Ebrahimpour (2003) selected 76 literatures related to TQM activities from 1989 to 2000 and reorganized the key success factors of effective TQM activities execution, including leadership, strategic planning, customer and market orientation, data analysis, human resource management and process management. Antony *et al*. (2002) suggested 11 key success factors of the execution of TQM activities, including educational

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training, quality data and figure analysis, the managers' commitment, customer satisfaction orientation, role of quality control department, communication for quality improvement, continuous improvement, product and service design, the suppliers' quality management, manufacturing management and employee relationship. Based on literature review, Motwani (2001) generalized 7 constructs of the execution of TQM activities: high-rank managers' support, quality measurement and benchmarking, manufacturing management, product design, employee training and empowerment, supplier quality management and customer participation and satisfaction. Based on literature review, this study divided the implementation of TQM activities into 5 constructs: leadership, data analysis, human resource management, process management and market orientation.

Garvin (1988) indicated that the companies must implement TQM activities by proper strategies. Juran and Gyrna (1993) indicated that differentiation strategy and cost leadership strategy were effective for the implementation of TQM activities. Prajogo and Sohal (2001) suggested that the implementation strategies of TQM activities included differentiation strategy and cost leadership strategy. The firms' different strategies would differently affect the execution degree of TQM activities. According to Belohlav (1993), the execution of TQM activities should be based on cost leadership strategy and differentiation strategy in order to enhance the execution effect of TQM activities; TQM activities upon differentiation strategy aimed to provide better products or services to satisfy the customers' needs. Cost leadership strategy aimed to reduce the cost and avoid the flaws and wastes. Reed *et al.* (1996) suggested that cost leadership and differentiation strategy in the companies would enhance the execution effect of TQM activities. Based on the above deduction, the following hypothesis is proposed:

- **H_1:** The executive degree of implementation strategies (cost leadership and differentiation) of TQM had significant influence on the executive degree of the TQM activities

Westbrook and Utley (1995) and McNabb and Sepic (1995) indicated the critical role of organizational culture on the implementation of TQM activities. According to Kekale and Kekale (1995), different types of organizational culture would influence the implementation level of TQM activities. Maull *et al.* (2001) suggested that organizational culture would influence the execution level of TQM activities. Prajogo and Sohal (2001) argued that organizational culture would affect execution degree of TQM activities. Different kinds of organizational culture would influence execution degree of TQM activities differently. Kujala (2004), Metri (2005) and Powell (1995) indicated that organizational culture would affect execution degree of TQM activities and the construction of proper organizational culture would facilitate the implementation of TQM activities. Mosadegh Rad (2006) further suggested that the establishment of quality-oriented organizational culture would significantly and positively affect execution degree of TQM activities. Based on the above deduction, the following hypothesis is proposed:

- **H_2:** Companies with high execution degree of organization culture have significant effects on the executive degrees of TQM activities

Krajewski and Ritzman (2002) and Easton and Jarrell (1998) suggested that the implementation of TQM activities could increase inventory turnover ratio, reduce inventory, solve the problems of scheduling and production, encourage the employees to continue improving the process and product quality and enhance operational performance. Agus and Abdullah (2000b) proposed that the execution time of TQM activities would influence operational performance. With longer execution time, operational performance would be better. Hendricks and Singhal (2001) suggested that when the management support and involve in TQM activities, operational performance would be better. Bounds *et al.* (1994), Ahire *et al.* (1996), George and Weimerskirch (1998) and Flynn *et al.* (1995) suggested that the execution of TQM activities positively influenced operational performance. The implementation of TQM activities could reduce the defective rate of the products, reduce the production time, increase product quality and result in competitive advantages. Douglas and Judge (2001) indicated that the companies which implemented TQM activities would have more competitive advantages than those without TQM activities. Based on the above deduction, the following hypothesis is proposed:

- **H_3:** The executive degree of the TQM activities reveals a significant influence on operating performance

Agus and Abdullah (2000a) studied the influence of TQM implementation of the firms in different industry groups of Malaysia on operational performance by questionnaire survey and showed that the firms in different industry groups implemented TQM activities differently. Different execution degrees of TQM activities

would lead to different operational performance. As to enterprise scale, Quek and Yusof (2003) suggested that large-scale enterprises' implementation level of TQM activities was different from that of small and medium enterprises. Large-scale enterprises had more resources and their implementation level of TQM activities and operational performance were better than those in small and medium enterprises. Moreover, Terziovski and Samson (2000) demonstrated that comparing with small-scale firms, the implementation level of TQM activities in large-scale enterprises was more significant and they were more likely to reduce the defective rate and guarantee cost of the products. However, Hendricks and Singhal (2001) demonstrated the opposite results which showed that comparing with large-scale enterprises, small enterprises could effectively implement TQM activities and enhance their operational performance. Based on the above deduction, the following hypothesis is proposed:

- **H_4:** The executive degree of the TQM activities of firms with different characteristics reveals a significant influence on operational performance

RESEARCH METHOD

This research explores the correlation among implementation strategies of TQM, execution Degree of organizational culture, TQM Activities implementation level and operational performance in Taiwan's High-Tech Firms. The research framework for this study is shown in Fig. 1.

Research hypotheses: As a result of the literature exploration, this research developed the following hypotheses:

H_1: The executive degree of implementation strategies (cost leadership and differentiation) of TQM had significant influence on the executive degree of the TQM activities

- **H_{1-1}:** The executive degree of cost leadership strategy of TQM had significant influence on the executive degree of the TQM activities

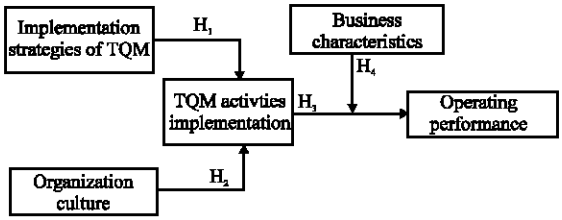

Fig. 1: Research framework

- **H_{1-2}:** The executive degree of differentiation strategy of TQM had significant influence on the executive degree of the TQM activities

H_2: Companies with high execution degree of organization culture have significant effects on the executive degrees of TQM activities

- **H_{2-1}:** Companies with high execution degree of rational culture have significant effects on the executive degrees of TQM activities
- **H_{2-2}:** Companies with high execution degree of hierarchical culture have significant effects on the executive degrees of TQM activities
- **H_{2-3}:** Companies with high execution degree of group culture have significant effects on the executive degrees of TQM activities
- **H_{2-4}:** Companies with high execution degree of developmental culture have significant effects on the executive degrees of TQM activities

H_3: The executive degree of the TQM activities reveals a significant influence on operating performance

- **H_{3-1}:** The executive degree of the TQM activities reveals a significant influence on quality performance
- **H_{3-2}:** The executive degree of the TQM activities reveals a significant influence on financial performance
- **H_{3-3}:** The executive degree of the TQM activities reveals a significant influence on inventory management performance

H_4: The executive degree of the TQM activities of firms with different business characteristics reveals a significant influence on operational performance

- **H_{4-1}:** The executive degree of the TQM activities of firms with different industry groups reveals a significant influence on operational performance
- **H_{4-2}:** The executive degree of the TQM activities of firms with different enterprise scales reveals a significant influence on operational performance

Questionnaire collection and data analysis: The subjects of this research were Taiwan high-tech firms in the Hsinchu Science-Based Industrial Park and Southern Taiwan Science-Based Industrial Park. The questionnaire respondents must have a thorough understanding of TQM activities. Quality management supervisors at these companies were the target respondents. The questionnaires were anonymous and distributed to 515 companies at the beginning of October 2009. A total of 73

Table 1: Reliability values for all variables in this study

Questionnaire dimensions	Cronbach's α
TQM activities	
Leadership	0.892
Data analysis	0.836
Human resource management	0.874
Process management	0.923
Market orientation	0.920
Implementation strategies of TQM	
Cost leadership	0.845
Differentiation	0.872
Organizational culture	
Rational culture	0.833
Hierarchical culture	0.807
Group culture	0.887
Developmental culture	0.925
Operational performance	
Quality performance	0.858
Financial performance	0.919
Inventory management performance	0.771

effective samples were collected by December 2009. The questionnaire item design was based on literature review, consisting of five sections. Cronbach's α coefficient is widely used as an index of scoring reliability (Chien *et al*., 2010). Nunnally (1978) recommended that a reliability value of 0.7 or above is acceptable. The reliability values in this study were all above 0.7 and therefore reliable. The reliability values for all variables in this study are shown in Table 1. This research used SPSS statistical software to deal with data analysis. The data analysis method was Analysis of Variance (ANOVA). The ANOVA method is frequently used to explore the correlation between the various dimensions.

Measurement on the variables: The variables included TQM implementation strategies, organizational culture, TQM activities execution degree, operational performance, industry group and enterprise scale and the measurement was described below:

Implementation strategies of TQM: The implementation strategies of TQM in this study were based on Porter (1980) competitive strategies which included cost leadership and differentiation. The items of the strategies of TQM in this study were upon literature review (Dess and Davis, 1984; Prajogo and Sohal, 2006; Miller, 1988; Yamin *et al*., 1997; Chung *et al*., 2010). The strategies of TQM involved 2 constructs and 12 activities, as shown below:

- **Cost leadership:** The activities include: (1) increasing the efficiency by business control; (2) controlling product or service quality to reduce the defective cost; (3) training the employees to accumulate their manufacturing techniques and experience; (4) reducing the production or service cost; (5) reducing production or service cost by improving operation process efficiencies and utilizing information technology and (6) increasing the efficiency by utilizing learning curve and information technology
- **Differentiation:** The activities include: (1) reinforcing the design and the development of new product or service; (2) providing the customers with better products or services by the use of new techniques or information technology; (3) Processing market information by adopting information technology and providing the products or services according to the customers' different demands; (4) valuing the marketing skill to increase customer satisfaction; (5) serving the customers by professional team and (6) continuously improving the products or services to lead to more additional value than the rivals'

The scoring was based on Likert 5-point scale, where as 5 refers to Strongly agree, 4 refers to Agree, 3 refers to No comment, 2 refers to Disagree and 1 refers to Strongly disagree.

Organizational culture: The research of Dellana and Hauser (1999), Chang and Wiebe (1996), Prajogo and Mcdermott (2005) and Al-Khalifa and Aspinwall (2001) measured the influence of organizational culture on TQM activities by four cultures in competing values framework, this study treated four cultures in competing values framework as the constructs of organizational culture in the implementation of TQM activities. Organizational culture scale in this study was based on organizational culture questionnaire designed by Quinn (1988) upon competing values framework and organizational culture measurement proposed by Zammuto and Krakower (1991) and Parker and Bradley (2000). Organizational culture included 4 constructs and 20 indices, as shown below:

- **Rational culture:** (1) The firms value the work performance and task accomplishment; (2) the leaders in the firms guide the employees to fulfill the corporate targets, (3) the collective force of the firms is upon work performance and task accomplishment; (4) the organizational air is competitive and achievement-oriented and (5) the rewards for the employees would be based on the accomplishment of tasks
- **Hierarchical culture:** (1) The firms are the formal organizations with definite ranks and everyone's duties are regulated in details; (2) the leaders expect the employees to work upon the rules, policies or process; (3) the collective force is upon the laws and policies and the major task is to maintain the

successful operation; (4) the firms emphasize on the stability and efficiency of smooth operation and (5) the rewards for the employees are based on the ranks

- **Group culture:** (1) The firms are the human organizations and resembled a big family; (2) the leaders help the employees to develop their potential; (3) the collective force is based on loyalty ad mutual trust; (4) the companies value human resource, emphasized team work and stimulated the employees' morale; (5) the firms treat the employees with equal rewards.
- **Developmental culture:** (1) The firms are innovative and the employees are willing to undertake the risks and overcome the challenge; (2) the leaders encourage the employees to undertake the risks and be innovative; (3) the collective force is upon innovation and R and D and the firms intend to be the leaders in the market; (4) the firms value growth and new resources and are ready for new challenge at any time and (5) the rewards for the employees would be based on their creativity or plans

The scoring was based on Likert 5-point scale, where as 5 refers to Strongly agree, 4 refers to Agree, 3 refers to No comment, 2 refers to Disagree and 1 refers to Strongly disagree.

Execution degree of TQM activities: The items of TQM activities in this study were upon literature review (Black and Porter, 1996; Saraph *et al*., 1989; Antony *et al*., 2002; Seetharaman *et al*., 2006; Flynn *et al*., 1995; Tamimi, 1995; Powell, 1995; Ahire *et al*., 1996; Motwani, 2001; Ismail and Ebrahimpour, 2003). TQM implementation involved 5 constructs and 35 activities, as shown below:

- **Leadership:** The activities include: (1) the managers would regularly guide the members and examine the business and service quality; (2) the managers show determination of TQM implementation; (3) the managers treat quality as the priority in decision-making; (4) distributing the resources and improving the quality; (5) regularly examining the effect of quality management system; (6) carefully establishing the goals of business and service quality; (7) encouraging the employees to participate in quality management and (8) including the continuous improvement in the targets and plans constructed
- **Data analysis:** The activities include: (1) the firms would collect, reorganize and analyze quality related data; (2) treating the major rivals' advantages as the model; (3) finding the key quality index for analysis; (4) constructing effective quality data and performance measurement; (5) ensuring the completeness of data saving and the transmission; (6) immediate delivery of quality information to the related departments and (7) allowing the employees to easily acquire quality information
- **Human resource management:** The activities include: (1) educational training for the employees and regularly evaluating the results; (2) encouraging the employees' innovation and continuous improvement; (3) rewarding the employees who were devoted to fulfill the quality goals; (4) distributing the necessary resources to the employees and solving their problems; (5) encouraging the employees to propose the suggestion on quality improvement for further execution; (6) establishing the incentive system which met the employees' needs and (7) integrating manpower and solving the problems by the team of different departments
- **Process management:** The activities include: (1) the firms would monitor the business and service process by statistical method; (2) continuously improving the business and service process to enhance the quality; (3) improving the business and process by quality control; (4) designing business and service process by quality factors; (5) regularly reviewing and properly modifying the process indices; (6) continuously examining and measuring the process performance; (7) selecting the suppliers by quality performance and (8) constructing long-term cooperation with the suppliers
- **Market orientation:** The activities include: (1) the firms would actively study the customers' complaints; (2) probing into the customers' satisfaction with the products or services by systematic survey; (3) collecting the customers' responses to control their needs; (4) immediately responding to the customers' comments and (5) actively finding the approaches to increase customer satisfaction

The scoring was based on Likert 5-point scale, where as 5 refers to Strongly agree, 4 refers to Agree, 3 refers to No comment, 2 refers to Disagree and 1 refers to Strongly disagree.

Operational performance: Upon literature review (Kaynak, 1997, 2003; Flynn *et al*., 1995; Samson and Terziovski, 1999; Ahire *et al*., 1996; Powell, 1995; Huarng and Chen, 2002; Quazi *et al*., 1998; Su *et al*., 2003; Saraph *et al*., 1989; Brah *et al*., 2002; Maani *et al*., 1994; Krajewski and Rizman, 2002; Easton and Jarrell, 1998), this study divided the operational performance of TQM implementation into three constructs:

- **Quality performance:** The indices include the increase of product or service quality, increase of productivity, reduction of defective rate of products or services and reduction of product delivery or customer service time
- **Financial performance:** The indices include the increase of profits, market share and return of investment
- **Inventory management performance:** The indices include the increase of inventory turnover rate and the reduction of inventory

The scoring was based on Likert 5-point scale, where as 5 refers to Strongly agree, 4 refers to Agree, 3 refers to No comment, 2 refers to Disagree and 1 refers to Strongly disagree.

Evaluation of industry groups and enterprise scales: In terms of business characteristics, industry groups and enterprise scales are the major areas of discussion in this study:

- **Industry groups:** Manufacturers are classified according to the 2009 directory for manufacturers in the park. There is an integrated circuit industry, a computer and peripherals industry, a telecommunication industry, an electro-optical industry, an automation industry and a biotechnology industry
- **Enterprise scales:** According to the identification standard for domestic industries adopted by the Ministry of Economic Affairs, manufacturers are divided into two classes of scale based on their number of employees. There are: large enterprises, the number of employees exceeding 200; small and medium enterprises, the number of employees under 200

RESULT OF VERIFICATION

The relationship between implementation strategies of TQM and the executive degree of TQM activities: Here, explores if the executive degrees of implementation strategies of TQM reveal significant influence on the executive degrees of five TQM activities dimensions. Table 2 shows the ANOVA results of implementation strategies of TQM and the degree of executive influence for each TQM activity dimension. The research results in Table 2 confirm the following hypothesis: H_1, H_{1-1} and H_{1-2}.

The relationship between organization culture and the executive degree of TQM activities: Here, explores the possibility of the executive influence in the various organization cultures showing a significant influence on the five TQM activity dimensions. Table 3 shows the ANOVA results of organization culture and the degree of executive influence for each TQM activity dimension. The research results in Table 3 confirm the following hypothesis: H_2, H_{2-1}, H_{2-2}, H_{2-3} and H_{2-4}.

Table 2: ANOVA of implementation strategies of TQM and the TQM activities implementation level

Factors	Statistical value	Cost leadership	Differentiation
Leadership	F-value	31.870	23.243
	p-value	<0.001*	<0.001*
	LSD	A<B<C	A<B<C
Data analysis	F-value	35.358	20.496
	p-value	<0.001*	<0.001*
	LSD	A<B<C	A,B<C
Human resource management	F-value	20.162	21.224
	p-value	<0.001*	<0.001*
	LSD	A<B<C	A<B<C
Process management	F-value	22.761	20.203
	p-value	<0.001*	<0.001*
	LSD	A<B<C	A,B<C
Market orientation	F-value	26.997	16.592
	p-value	<0.001*	<0.001*
	LSD	A<B<C	A<B<C

A: Score is less than 3.5; B: Score is less than 4.5; C: Score is more than 4.5;*p<0.5

Table 3: ANOVA of organization culture and executive involvement in each dimension of TQM activities

Factors	Statistical value	Rational culture	Hierarchical culture	Group culture	Developmental culture
Leadership	F-value	19.983	10.306	15.597	8.403
	p-value	<0.001*	<0.001*	<0.001*	0.001*
	LSD	A<B<C	A<B<C	A<B<C	A , B<C
Data analysis	F-value	11.951	7.978	16.841	10.659
	p-value	<0.001*	0.001*	<0.001*	<0.001*
	LSD	A,B<C	A,B<C	A<B<C	A,B<C
Human resource management	F-value	18.689	11.860	16.482	8.505
	p-value	<0.001*	<0.001*	<0.001*	<0.001*
	LSD	A<B<C	A<B<C	A<B<C	A,B<C
Process management	F-value	14.500	10.995	8.963	9.497
	p-value	<0.001*	<0.001*	<0.001*	<0.001*
	LSD	A<B<C	A<B<C	A,B<C	A<B<C
Market orientation	F-value	9.020	5.704	9.512	10.667
	p-value	<0.001*	0.005*	<0.001*	<0.001*
	LSD	A<B<C	A,B<C	A<B,C	A<B,C

A: Score is less than 3.5; B: Score is less than 4.5; C: Score is more than 4.5; *p<0.5

The relationship between executive involvement in TQM activities and operational performance: This section was to explore if the implementation of each dimension of TQM activities significantly influenced three aspects of operational performance (quality performance, financial performance and inventory management performance). We divided each dimension of TQM activities into two levels (high and low), according to the average values for each factor, to test the significance of executive influence. Table 4-6 revealed the ANOVA results for the correlation between five executive involvement in each TQM activity dimension and operational performances. The results showed the support of H_3, H_{3-1}, H_{3-2} and H_{3-3}.

Table 4: ANOVA of executive involvement in TQM activities and quality performance

	Quality performance			
Activities	Low	High	F-value	p-value
Leadership	3.948	4.500	23.634	<0.001*
Data analysis	3.950	4.382	13.244	0.001*
Human resource management	3.964	4.306	7.291	0.009*
Process management	3.994	4.464	15.219	<0.001*
Market orientation	3.904	4.410	19.483	<0.001*

*p<0.05

Table 5: ANOVA of executive involvement in TQM activities and financial performance

	Financial performance			
Activities	Low	High	F-value	p-value
Leadership	3.721	4.256	11.155	0.001*
Data analysis	3.695	4.167	8.675	0.004*
Human resource management	3.703	4.089	5.293	0.024*
Process management	3.771	4.215	7.141	0.009*
Market orientation	3.696	4.154	8.102	0.006*

*p<0.05

Table 6: ANOVA of executive involvement in TQM activities and Inventory management performance

	Inventory management performance			
Activities	Low	High	F-value	p-value
Leadership	3.698	4.150	7.986	0.006*
Data analysis	3.700	4.053	4.802	0.032*
Human resource management	3.661	4.022	4.780	0.032*
Process management	3.744	4.107	4.814	0.032*
Market orientation	3.618	4.115	10.221	0.002*

*p<0.05

The influence of the executive degree of TQM activities of the firms with different business characteristics on operational performance: Here, examined the influence of the executive degree of TQM activities in the firms with different business characteristics (industry groups and enterprise scales) on business operational performance. The research results of Table 7 showed that business characteristics did not have a significant influence on the executive degrees of the five dimensions of TQM activities. The research results in Table 8 revealed that the firms with different industry group and enterprise scales did not reveal a significant influence on their operational performance. In accordance with the analytical results in Table 7 and 8, we rejected hypothesis H_4, H_{4-1} and H_{4-2}.

The research results in Table 2 confirm the following hypothesis H_1: The degree of TQM strategy executive implementation (cost leadership and differentiation) of TQM had a significant influence on the degree of executive TQM activity. The results support the viewpoints of Juran and Gyrna (1993), Prajogo and Sohal (2001), Belohlav (1993) and Reed *et al.* (1996). The research results in Table 3 confirm the following hypothesis: Companies with a high degree of execution

Table 7: ANOVA of business characteristics and executive involvement in each dimension of TQM activities

	Industry group		Enterprise scale	
Activities	F-value	p-value	F-value	p-value
Leadership	0.518	0.762	0.461	0.633
Data analysis	0.566	0.726	0.539	0.586
Human resource management	0.653	0.660	0.484	0.618
Process management	0.558	0.732	0.291	0.748
Market orientation	1.059	0.391	0.578	0.564

Table 8: ANOVA of business characteristics and operational performance

	Industry group		Enterprise scale	
Characteristics	F-value	p-value	F-value	p-value
Quality performance	0.742	0.595	0.363	0.697
Financial performance	0.416	0.836	0.686	0.507
Inventory management performance	0.569	0.723	0.319	0.728

organization culture has significant effects on the degree of executive TQM activities. The results support the viewpoints of Prajogo and Sohal (2001), Kujala, (2004), Metri (2005), Powell (1995) and Maull *et al.* (2001). The research results in Table 4-6 confirm the following hypothesis H_3: The degree of executive TQM activities reveals a significant influence on operating performance. The results support the viewpoints of Agus and Abdullah (2000b), Bounds *et al.* (1994), Ahire *et al.*, (1996), George and Weimerskirch (1998), Flynn *et al.* (1995) and Hendricks and Singhal (2001). The research results in Tables 7 and 8 reject the following hypothesis H_4: The degree of executive TQM activities at firms with different characteristics reveals a significant influence on operational performance. The reason might be that these firms, regardless of industry group or enterprise scale, had already recognized the importance of executing TQM activities and their implementation reached a certain level and therefore, there was no difference across industry groups or enterprise scales.

CONCLUSIONS

This study probes into the influences of TQM implementation strategies and organizational culture on the TQM execution degree and the TQM execution degree effect on operational performance. It also considers the moderating variables (industry group and enterprise scale) and developed a theoretical model of the relationship using theoretical and literature review. This study treats high-tech firms as the targets and finds that TQM implementation strategies (cost leadership and differentiation strategy) have significant influences on TQM activities. Organizational culture (rational culture, hierarchical culture, group culture and developmental culture) also significantly influences the execution of

TQM activities. TQM execution degree significantly affects operational performance (quality performance, financial performance and inventory management performance). The hypothesis that Higher TQM execution degree leads to better operational performance is validated statistically.

With regard to the moderating variables (industry group and enterprise scale), this study found that they do not reveal a significant influence on the TQM execution degree and operational performance. When reinforcing the operational performance, the firms should first enhance the execution of TQM activities. In order to significantly enhance the execution degree of TQM activities, firms can improve cost leadership and differentiation strategy implementation and combine the characteristics of four cultures (group culture, developmental culture, hierarchical culture and rational culture). This study only targeted high-tech firms and in the future can conduct empirical analysis on other industries (such as traditional ones) to acquire more complete research findings.

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