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Quality Management, Green Practice and Enterprise Performance

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Abstract
Based on the questionnaire of 403 data samples from 13 countries in the world, we used structural equation model to study the relationship between soft quality management, hard quality management, green practice and firm performance. Our study showed that soft QM only positively influences external green practice (GP) but has no effect on internal green practice (GP); while hard QM can effectively promote the implementation of green practice, both internal and external. We also found strong relationship between environmental performance and economic performance, which is consistent with previous literature findings.

Key words: Soft quality management; Hard quality management; Internal green practice; External green practice; Economic performance

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INTRODUCTION

Product quality is the guarantee of sustainable development of enterprises, enterprises are the main responsibility for quality and safety. However, with the widespread of the environmental awareness, the emphasis in quality management has shifted away to the focus of being green. According to a survey that Carter had investigated in the United States, 75% of consumers prefer green products and 80% are willingness to pay higher prices for green products (Carter at el., 2000). However, there are many uncertainties in implementing green practices. Huge investment for all resources, high R&D failure rate, unknown product acceptance as well as the long payback period are all the obstacles that prevent entrepreneurs from doing so. Therefore, how to stimulate managers to integrate internal and external resources to adopt green practices has also become a key issue for scholars in recent years. Based on the fundamental researches of QM, this paper explores the impact of quality management on the implementation of green practices and illustrates the relationship between green practices and environmental performance and economic performance.

Our study makes several contributions to the literature. First, previous researches barely noticed the relationship between QM and EM. Even few do, they discuss it with the macroscopic angle. Our paper studies the relationship from a practical perspective. Second, we divide quality management into two different dimensions as soft QM and hard QM, and green practice into internal GP and external GP. Third, unlike previous literatures, we examine the relationship between green practice and firm performance (environmental performance and economic performance) from two sides, internal and external. In addition, we also look into the influence of environmental performance on economic performance.

1. THEORY AND HYPOTHESESS

1.1 Soft QM and Hard QM

Wilkinson (1992) maintains that QM has both “hard” and “soft” sides. Hard QM pertains to the technical aspects

of QM, whereas soft QM relates to the social/behavioral attributes of QM. Although the classification criteria of each study are different, in this paper we intend to adopt Wilkinson (1992) classification where the QM is divided into hard QM and soft QM.

Hard QM is often linked to quality improvement tools and technologies. The practices of the hard QM include organizational process control, statistical process control, just in time, information feedback, etc. (Samson & Terziovski, 1999). Compared with the soft QM, hard QM is more practical and easy to quantify.

Soft QM is generally associated with management concepts such as top management support, employee engagement, and employee training (Dow et al., 1999; Powell, 1995), which emphasize the role of human.

1.2 Internal Green Practice and External Green Practice

Green supply chain management (GSCM) definition has ranged from green purchasing to integrated supply chains flowing from supplier, to manufacturer, to customer and reverse logistics, which is "closing the loop" as defined by supply chain management literature (Zhu & Sarkis, 2004). In this case, for our paper, we shall focus on the internal and external green practice. Internal green practice (IGP) is the endeavor we take inside of the company to reduce waste and improve our efficiency, such as replace the unsustainable materials with renewable resources. External green practice (EGP) refers to the involvement of suppliers. The establishment of an internal green practice helps companies extend their external green practices (Zhu et al., 2005). Gonzalez's study of the Spanish automotive industry also confirms the contribution of internal green practices to external green practices (Gonzale & Hidalgo, 2008) .

1.3 Hypotheses Development

1.3.1 The Relationship Between Soft QM and GP

Numerous researches have explicitly or implicitly explained the linkages between quality management and green practice (examples include Klassen and McLaughlin (1993), Hanna and Newman (1995), and Pojasek (2002). Prior studies found that quality management practices result in a higher growth in total assets, firm performance, and stock market performance (Hendricks & Singhal, 1997; 2001; Kaynak, 2003). Quality management initiatives along with worker empowerment, materials recycling, and "cleaner" technologies adopting can improve environmental and economic performance (Rao & Holt, 2005).

Zhu and Sarkis compared the implementation plans of ISO9000 and ISO14000 and proposed that quality management is the basis for enterprises to implement green practices and believes that quality management is crucial to improving internal environmental management (Zhu & Sarkis, 2004). Both of these management systems (quality management and internal environmental management) share common implementation factors (such as leadership, personnel management and stakeholder focus) and can effectively improve company's competitiveness.

Through a review of the quality management literature (Saraph et al., 1989; Kaynak, 2003) and the green practice literature (Klassen & McLaughlin, 2003), we find that there are many common practices in quality management and green practices (such as leadership support, staff training, continuous self-assessment and improvement). QM and GP all attach great importance to long-term planning, employee training, continuous self-assessment and improvement, which are all soft QM practices. When implementing green practices, enterprises can draw the successful experience from QM and it would be less time and energy consuming. Therefore, we think that soft QM can effectively lower the difficulty for implementing internal GP and building motivation. In addition, the internal emphasis on quality is bound to the choice of suppliers. Green raw materials will help improve product quality and enhance the competitiveness. So we suggest that soft QM can help companies to implement external GP.

Hence, we hypothesize,

Hypothesis 1a.: Soft QM has a positive relationship with internal green practice.

Hypothesis 1b.: Soft QM has a positive relationship with external green practice.

1.3.2 The Relationship Between Hard QM and GP

The "zero defect" quality management objective in QM is closely related to the "waste-free" environmental management goals with green practice. Similar to product defects in quality management, pollution and waste in green practices are also the manifestation of poor efficiency (Porter & Van der Linde, 1995). In hard QM sense, product design, process control, and timely feedback on production information draw experience for the green practices. Given the parallels between QM and GP, applying quality management knowledge to environmental issues makes it easier for implementing green practices (Klassen & McLaughlin, 1993). Curkovic suggests that companies can develop a system to reduce and eliminate all waste streams associated with the design, manufacture, to enhance corporate green practices by strengthening controls and recycling of waste (Curkovic et al., 2000). Darnall and Edwords argue that the skills required to adopt new technologies complement and improve the quality management capabilities of enterprises (Darnall & Edwords, 2006). King and Lenox also point out that enterprises that have established a standard quality management system are more willing to adopt green practices (King & Lenox, 2001). So, we think that hard QM helps companies adopt internal green practices. In addition, based on the general concept of QM, Zhu

found that QM can effectively regulate the relationship between external green practices and business performance and concluded that for quality management Enterprises to implement external green practices is relatively easier from empirical research on 186 manufacturing enterprises in China (Zhu & Sarkis, 2004). For enterprises that have established a standard quality management process, there is no doubt that upstream suppliers who meet and even exceed their quality standards will be selected to ensure "zero defect" in the production process.

Hence, we hypothesize,

Hypothesis 2a.: Hard QM has a positive relationship with internal green practice.

Hypothesis 2b.: Hard QM has a positive relationship with external green practice.

1.3.3 The Relationship Between GP and Firm Performance

Some studies find a positive relationship between green and firm performance (Judge & Douglas, 1998; King & Lenox, 2002), and point out that green practices reduce the emission of harmful substances and improve resource utilization rate. More importantly, the promotion of corporate reputation attract environmental sensitive consumers. At the same time, the strengthening of competitive power brings more market share and sales profits to the enterprises. Even though the findings about these relationships are mixed, most studies agree that EM has positive effects on firm performance (Claver-Cortés et al., 2005).

King and Lenox suggest that internal green practices may lead to firm performance improvement through cost savings and differentiation strategies (Melnyk et al., 2003; Montabon et al., 2007). Preventing pollution saves costs, reduce companies' input and energy consumption, and helps to recycle materials (Hart, 1997). Green products may motivate environmentally conscious consumers' willingness to buy. As a result, environmental management can help companies achieve a corporate image that benefits businesses and the environment (Porter and Van der Linde, 1995).

Hence, we hypothesize,

Hypothesis 3a.: Internal GP has a positive relationship with environmental performance.

Hypothesis 3b.: Internal GP has a positive relationship with economic performance.

Green practice is not business alone, but also requires green integration with suppliers. The loss for the enterprise will be incalculable if companies make improper supplier selection. Whether enterprises can successfully develop green products, largely depends on the supplier's environmental capacity.

Most multinational companies in China prefer to choose higher-priced environmentally-friendly materials from their own country, instead of Chinese companies as having a low level of environmental protection (Zhu & Geng, 2001). Rao and Holt think that suppliers' green practices reduce the waste of resources and the cost of pollution prevention so as to positively impact the environmental performance (Rao & Holt, 2005). Zhu finds, green practices outside the enterprise can not only bring environmental performance improvement, but also have a significant positive impact on economic performance (Zhu et al., 2005; Zhu & Sarkis, 2004). Enterprises tend to cooperate with environmental suppliers and choose environmentally-friendly materials to enhance their internal production efficiency, improve the utilization of raw materials, reduce energy consumption and the emission of harmful substances within and outside the organization.

Hence, we hypothesize,

Hypothesis 4a.: External GP has a positive relationship with environmental performance.

Hypothesis 4b.: External GP has a positive relationship with economic performance.

1.3.4 The Relationship Between Environmental Performance and Firm Performance

Klassen and McLaughlin (1996) point out that green practices can effectively improve business performance. Although due to the large initial investment of enterprises, the payback period may be longer. It is undeniable that green practices have created a good corporate social reputation. In the context of growing consumer awareness of environmental protection, Laroche et al. (2001) found that consumers are willing to pay higher prices for environmentally friendly products. In this way, improving the environmental performance of enterprises undoubtedly attracts customers, and at the same time Improve product prices help companies recover costs and create revenue. From a natural-based perspective, environmental performance is bound to economic benefits. Good environmental performance means higher awareness of environmental protection, which proves that the utilization rate of resources is relatively high. Because the cost of environmental pollution control is lower, thereby corporate governance costs and pollution penalties would save lots of money.

Hence, we hypothesize,

Hypothesis 5: Environmental performance has a positive relationship with economic performance.

Therefore, the conceptual model of this article is as follows:

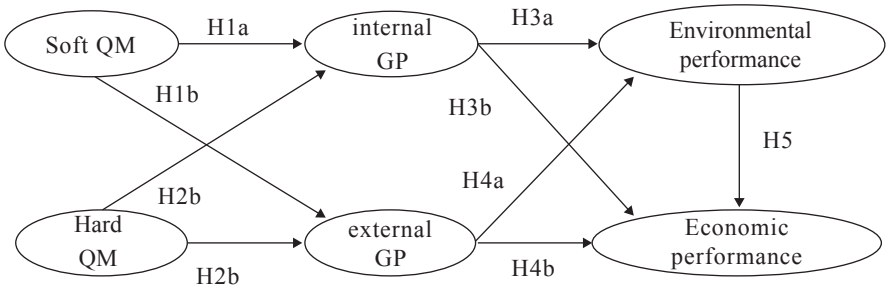

Figure 1
Conceptual Model

2. RESEARCH METHODS AND HYPOTHESIS TESTS

2.1 Sample

Data used in this study were collected through an international joint research. This project aims to study management practices and their impact on plant performance within global competition. The sample consists of 304 manufacturing plants which are both traditional and world-class plants, and was stratified by industry and nation. There are thirteen countries and regions included in the sample: Brazil, Germany, Spain, Iceland, Switzerland, Italy, Japan, China, Korea, Finland, Taiwan, United Kingdom and Vietnam.

The questionnaire used in this study includes four parts, quality management, green practice, environmental performance, economic performance. As the existing maturity scale is mainly in English description, so we take the "two-way translation" approach. First, the researchers translated into Chinese, and then other researchers translated into English. Through the comparison of continuous correction, we strive to make sure the formation of questionnaires in English and Chinese.

2.2 Measures

To operationalize hard QM and soft QM, we select measurement scales from the HPM database. Followed by the literature we mentioned is section 2.1, hard QM and soft QM are conducted by three different measurement scales. Process control, feedback, and product design, are used to measure hard QM, whereas soft QM is measured by top management support, employee training, and group problem solving.Five dimensions are here to measure the internal GP and external GP respectively (Zhu & Sakis, 2004, 2006). environmental performance was derived from Zhu and Sarkis (2004), and the scale of economic performance was come from (Vachon & Klassen, 2008).

These measurement scales are measured by perceptual questions over five points on the Likert scale (1=strongly disagree to 5=strongly agree). Each of the measured indicators in the unified enterprise by a number of respondents, the respondents from the different positions: frontline staff, human resources manager, quality manager, supervisor, process workers, plant executives.

2.3 Analysis

Before the questionnaire was collected, the content validity of the variables had been ensured by pre-documenting, manager interviews and pre-tests. After the questionnaire collection, the study used a series of rigorous data analysis methods to ensure the reliability and validity of variables. We used the exploratory factor analysis (EFA) to calculate the Cronbach's alpha value by SPSS 20.0 software to verify the reliability of the variable. The results in Table 1 show that the Cronbach's alpha values for each variable is above 0.6, indicating that the reliability of the collected data is acceptable. In addition, Gefen pointed out that the combination reliability (CR) represents the consistency and credibility of all variables. In our paper, the CR value of each variable is variable 0.8 which is far off the standard value 0.7. Therefore, it also proves that the variables have good reliability. Finally, We examined the validity of constructs by confirmatory factor analysis (CFA). The factor loading and AVE equivalent calculated by smart PLS are shown in Table 2. According to Gefen, the factor loading for each variable is basically above 0.7, and the value of AVE is greater than 0.5, indicating that the convergence of the construction is acceptable.

Table 1
Reliability and Convergent Validity

Measurement	Loading
Hard QM (Cronbach'a=0.934; C.R.=0.942; AVE=0.539)	
Feedback (Cronbach'a=0.827; C.R.=0.879; AVE=0.592)	
Charts showing defect rates are posted on the shop floor.	0.786
Charts showing schedule compliance are posted on the shop floor.	0.770
Charts plotting the frequency of machine breakdowns are posted on the shop floor.	0.755

To be continued

Continued

Measurement	Loading
Information on quality performance is readily available to employees.	0.803
Information on productivity is readily available to employees.	0.731
Process Control (Cronbach' a=0.901; C.R.=0.927; AVE=0.718)	
Processes in our plant are designed to be "foolproof".	0.780
A large percent of the processes on the shop floor are currently under statistical quality control.	0.882
We make extensive use of statistical techniques to reduce variance in processes.	0.887
We use charts to determine whether our manufacturing processes are in control.	0.816
We monitor our processes using statistical process control.	0.868
Design for Quality (Cronbach' a=0.811; C.R.=0.876; AVE=0.639)	
New products are thoroughly reviewed before they are produced and marketed.	0.818
Departments work in a coordinated manner in the product development process	0.748
Product specifications and procedures for new products are clear.	0.823
Implementation and producibility are considered in the product design process.	0.807
Soft QM (Cronbach'a =0.934; C.R.=0.944; AVE=0.0.605)	
Top Management Leadership for Quality (Cronbach'a=0.865; C.R.=0.903; AVE=0.650)	
Plant management provides personal leadership for quality products and quality improvement.	0.764
The top priority in evaluating plant management is quality performance.	0.851
Our top management strongly encourages employee involvement in the production process.	0.768
Our plant management creates and communicates a vision focused on quality improvement.	0.802
Our plant management is personally involved in quality improvement projects.	0.843
Task-Related Training for Employees (Cronbach'a=0.862; C.R.=0.916; AVE=0.783)	
Our plant employees receive training and development in workplace skills, on a regular basis.	0.896
Management at this plant believes that continual training and upgrading of employee skills is important.	0.776
Our employees regularly receive training to improve their skills.	0.889
Small Group Problem Solving (Cronbach'a=0.833; C.R.=0.900; AVE=0.750)	
Our plant forms teams to solve problems.	0.870
In the past three years, many problems have been solved through small group sessions.	0.823
Problem solving teams have helped improve manufacturing processes at this plant.	0.903
Internal Green Practice (Cronbach'a=0.873; C.R.=0.914; AVE=0.726)	
Use of cleaner technologies in the production process (e.g. abatement equipment) to reduce pollution emissions and/or resource use	0.785
Environment-friendly product design	0.891
Environmental improvement of packaging	0.870
Use of environment-friendly raw materials	0.858
External Green Practice (Cronbach'a=0.809; C.R.=0.874; AVE=0.635)	
Encouraging suppliers to improve the environmental performance of their processes	0.822
Giving preference to materials with third party certifications, such as Green Seal, FSC or Energy Star	0.755
Purchasing from minority- or women-owned business enterprise (M/WBE) suppliers	0.828
Starting or maintaining a formal M/WBE supplier purchase program	0.780
Enivronmental Performance (Cronbach'a=0.863; C.R.=0.900; AVE=0.642)	
Raw materials consumption	0.800
Emissions to air	0.816
Releases to water	0.776
Solid waste generation (e.g. landfill capacity consumed)	0.819
Waste recovery (e.g. recycling)	0.795
Economic Performance (Cronbach'a=0.722; C.R.=0.845; AVE=0.647)	
Cost performance	0.845
Revenue performance	0.856
Financial performance	0.704

Table 2
Means, Standard Deviation, Correlation Coefficients and Discriminant Validity

Variable	Mean	standard deviation	Soft QM	Hard QM	Internal GP	External GP	Environmental performance	Economic performance
Soft QM	3.898	0.5735	**0.825**					
Hard QM	3.739	0.6485	0.494**	**0.902**				
Internal GP	3.700	0.6755	0.325**	0.360**	**0.827**			
External GP	3.217	0.8242	0.278**	0.380**	0.716**	**0.801**		
Environmental performance	3.695	0.5806	0.184**	0.248**	0.432**	0.389**	**0.764**	
Economic performance	3.459	0.6284	0.141*	0.221**	0.278**	0.379**	0.428**	**0.914**

Note. The diagonal is the root value of each variable AVE.

3. MODEL PATH ANALYSIS AND RESULT DISCUSSION

3.1 Model Path Analysis

The hypotheses were tested using partial least squares (PLS) approach and PLS-Graph Software Version 3.0. We use PLS statistical software to build a conceptual model to examine the relationship between soft QM, hard QM and internal GP, external GP, and the impact of GP has on environmental performance and economic performance. Both soft QM and hard QM are second-order factors. The standard path coefficients of top management support, staff training and group problem solving on soft QM are 0.888, 0.915 and 0.579 respectively, *T* values are 35.506, 57.406 and 8.441 respectively. And the significance was less than 0.001, indicating that these three indicators are significantly and positively related. The standard path coefficients of information feedback, process control and product design on hard QM are 0.880, 0.852, 0.612, T values were 42.594, 29.565, 9.929 respectively. The significance was less than 0.001, which proved these factors are also significantly positive related.

The overall model results shown in Figure 2. Hard QM has no significant impact on internal GP, but can significantly affect external GP. H1 failing validation and H2 being verified. Soft QM can effectively promote the implementation of internal and external green Practice. H3 and H4 are supported. Internal GP can significantly improve the green performance, but cannot directly enhance the economic performance of enterprises. H5 is supported while H6 failed to pass the verification. External GP can enhance the environmental performance and economic performance of enterprises at the same time. This proves that H7 and H8 are supported. Finally, environmental performance can significantly improve the economic performance of enterprises. H9 is supported.

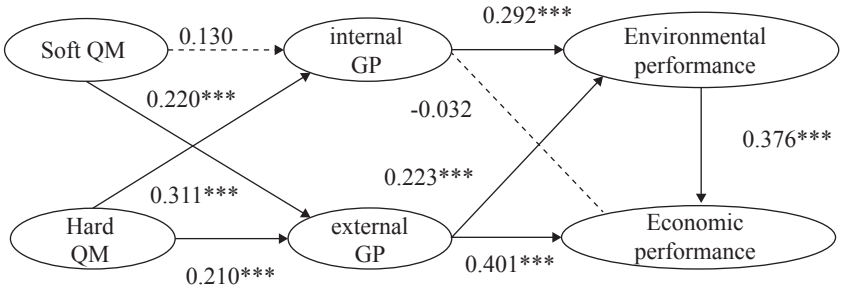

Figure 2
Path Coefficient

3.2 Result Discussion

This paper analyses the relationship between QM and GP, GP and firm performance, the influence of environmental performance on economic performance. We found that:

(a) Soft QM positively influences external green practice, while has no effect on internal green practice. Experience gained from soft QM can be applied to the implementation of green practice to promote quality and reduce the environmental issues. Compared with hard QM, which is easy to measure, soft QM does not significantly promote internal green practices. However, soft QM plays positively influence external GP because the emphasis on soft QM requires raw materials with high quality. And being green product means high quality. Environmental raw materials are good for water and electricity saving and work efficiency.

(b) Hard quality management has significantly influenced both internal and external green practice. In the hard QM sense, timely feedback, process supervision and product design are useful tools to know about the production situation and help enterprises to develop environmentally friendly high-quality products and discover the use of resources in production so as to reduce waste and enhance the green practice capability within the enterprise. The significance of hard QM to external GP is mainly reflected in the reason that companies can

accurately lock quality deviation through the feedback of visual hard QM results. The effect of green raw materials change is significantly observed which attach great importance for managers to do external GP.

(c) Internal GP has no effect on economic performance, which is consistent with most of the current academic research results, further emphasizing the green practice of the economic performance of the delay. The internal GP improves the environmental performance by solving the inefficient production problems, increasing the utilization rate of raw materials, recycling the products and reducing the waste of raw materials. However, high investment, long payback period and not easy to measure, resulting in a lag for economic performance and may even have a negative impact.

(d) External GP can effectively improve companies' environmental performance as well as economic performance. Enterprises through the green integration with suppliers, conscious choice of environmentally friendly raw materials, thereby enhancing the environmental quality of their products. Environmental performance also has a significant positive impact on economic performance because consumers are more willing to spend more on environmentally friendly products as the social awareness of environmental protection increases, resulting in increased economic efficiency.

CONCLUSION AND MANAGEMENT IMPLICATIONS

This paper has several academic implications. First, we analyse the model from two dimensional QM and GP, which are different from previous studies addressing on the concept of TQM. Second, it concludes that the relationships between QM and GP. We find it easy for companies to do environmental management when they already set up QM system. Third, we examine the impact of being green on the firm performance, which is somehow consistent with the previous studies.

This study also has a number of managerial implications. From the findings, plant managers can see the extent to how they influence and also the impact it has on firm performance. Thus, managers ought to take into account the fact that giving the experience they have on QM, it is not hard as they might consider to do green practice. What is more important is that it pays off, even though not as fast as we want. This is due to the fact that green practices improve companies' image invisibly and payback period is long. Even though they are aware that it is good to be green, some of them still less motivated to do so because of the high investment. In fact, QM facilitate an improvement for GP. The experience that managers can draw on from QM could be applied to the establishment of GP, and therefore remove some obstacle which prevents managers from doing so. Regarding the relationship between QM and EM, plant managers should be awarded that, when they implements QM, it may develop a set of competencies that facilitates the development and implementation of GP. This means that managers should take advantage of the resources and capabilities developed for QM in order to reduce the time and costs regarding to GP implementation. These practices can then reinforce the process of continuous improvement, which is beneficial to company in the long term.

Finally, this paper also has some limitations. This study used cross-sectional data, if needed, future studies could discuss it with panel data. In addition, the survey was accomplished in 2012 and the situation could be changed over these years. Therefore, the results should be taken with caution. What is more, although this paper is based on the international database, we neglect the culture difference. Hence, it is important to consider different culture background.

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