

DOES TQM SUPPORT INNOVATION PERFORMANCE IN MALAYSIA'S MANUFACTURING INDUSTRY?

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Abstract. This empirical study examines the association of TQM practices (i.e. leadership, customer focus, strategic planning, people management, information analysis and process management) with the innovation performance as perceived by the managers in Malaysia. The research model is constructed on the basis of established theory and on well-known criteria such as Malcolm Baldrige National Quality Award. Six hypotheses are formulated and tested by multiple regression based on a sample of 206 managers working in the ISO 9001:2000 certified manufacturing firms in Malaysia. The results of this study show that TQM has a significant positive relationship with innovation performance. In particular, the findings of this study show that process management, strategic planning, people management and customer focus have positive relationships with innovation performance of firms surveyed in Malaysia. Therefore, both researchers and practitioners are advised to consider these relevant TQM practices when assessing the innovation performance of an organization. Implications for managers and researchers, as well as study limitations are also discussed.

Keywords: TQM, innovation, Malaysia, manufacturing industry, multiple regression analysis, MBNQA, ISO 9000 quality system series.

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1. Introduction

Total quality management (TQM) has been widely used by many organizations and it has been applied as a management philosophy to provide customer and quality focused practices (Singh, Smith 2004; Easton, Jarrell 1998; Zafiroopoulos, Vrana 2008). TQM

has been recognized to play an important role for achieving competitive advantage for organizations (Prajogo, Sohal 2004a, 2004b). Given the importance of TQM, there are not many companies, especially those in manufacturing sectors can afford to ignore TQM (Prajogo, Sohal 2003; Dean, Bowen 1994). As Prajogo and Sohal (2006), and Bolwijn and Kumpe (1990) stated, in today's competitive environment, organizations are required to pursue more complex dimensions of performance, especially in both innovation and quality.

Innovation plays a significant role in helping business to attain a sustainable competitive edge (Prajogo, Sohal 2003; Tushman, Nadler 1986), especially in developing countries such as Malaysia where industrial growth has become an integral part of the economic development. In a hypercompetitive global environment, business organizations in the developing countries are increasingly seeking for innovation, shifting away from the previous focus on cost reduction for long term success (Shah Alam, Yasin 2010). Given that the manufacturing industry is the key driver for social and economic development in the developing countries (Zeng *et al.* 2010), promoting innovation should be one of the priorities of the developing countries in their economic agenda.

The link between TQM and innovation has stirred up a huge interest among scholars in the management field (Feng *et al.* 2006) and there are different arguments relating to the association between TQM and innovation (Prajogo, Sohal 2001). Although studies have been conducted by previous scholars to investigate the relationship between TQM and innovation performance around the globe, especially in the Western countries (Prajogo, Sohal 2003; Singh, Smith 2004; Tidd *et al.* 1997; Wind, Mahajan 1997; Slater, Narver 1998; McAdam *et al.* 1998), there are very few studies on the influence of TQM dimensions on innovation performance in the developing countries such as Malaysia, particularly within the context of the manufacturing sector.

A review of the recent literature showed that some researchers have explored the issues of innovation performance in developing countries such as the relationship between technology transfer and innovation performance (Guan *et al.* 2006), cooperation networks and innovation performance (Zeng *et al.* 2010), manufacturing strategies and innovation performance (Prajogo *et al.* 2007), and the determinants of innovation performance (Wang, Kafourous 2009). However, the aforementioned publications have limited their empirical studies within the context of China, Taiwan, Thailand and Vietnam. In accordance to the Malaysian Industrial Development Authority (2009), a report published by the Economist Intelligence Unit (2009) has shown that Malaysia was ranked No. 31 among the 82 countries on a survey – “A New Ranking of the World's Most Innovative Countries”. In the same survey published by the Economist Intelligence Unit (2009), China was ranked No. 54, India was positioned No. 56, Thailand was ranked No. 58, Indonesia was ranked No. 74, and by such measures, Malaysia has surpassed these developing countries in Asia in terms of innovation performance. In this regard, Malaysia provides an interesting and appropriate context for examining the relationship between TQM practices and innovation performance.

This study is motivated by the need to examine the influence of TQM practices on innovation performance in the manufacturing industry in Malaysia. Although Malaysia was

initially an agro-based economy, Malaysia has now become one of the fastest growing developing countries, having achieved significant rates of growth in the manufacturing sector over the past decades. Today, the manufacturing industry still makes up a major sector of Malaysia's economy, contributing approximately 40 percent of gross domestic product (GDP). Following the latest report from the Economist Intelligence Unit (2010), the manufacturing output raised by 12.9% year on year, and the values of merchandise exports and imports, production by the manufacturing and electricity industries and the rate of manufacturing sales increased by double digit rates in December 2009.

From the aspect of sociocultural impact on innovations in industry, Malaysia has an advantage of population profile, principally workforce's age and education levels. According to the Department of Statistics Malaysia (2010), Malaysia has a population of 28.31 million in 2009, in which 63.6 percent of the population is between 15–64 years old, 31.8 percent is below 15 years old, and 4.6 percent is above 65 years old. The proportion of people between 15–64 years old consists of 62.6 percent out of the total labor force in Malaysia, that is, 11,466,700 (Labor Force Survey 2010). Many of these working people aged between 15–64 years old are Generation Y employees. These Generation Y employees are educated, mostly up to levels roughly equivalent to United States high school diploma level, and they grew up technologically aware, globally conscious and internet savvy. Unlike many of the older employees, these young people are more likely to be outward looking, willing to challenge the status quo and be concerned about the innovation performance in the organization. Moreover, Malaysia has been experiencing the influx of skilled foreign workers in more than a decade, because Malaysia's standard of living is higher than surroundings countries (e.g., India, Indonesia, Philippines, Thailand, Cambodia and Laos). The number of foreign workers in the manufacturing industry in Malaysia is reported at 728,867 in year 2008 (Ministry of Home Affairs 2010). This is partly because of the wide usage of English, which makes working and living easy for the more educated foreign workers who are proficient in English.

In this regard, the study on the linkage between TQM and innovation performance is important as it provides a theoretical as well as a practical platform for the Malaysian manufacturing industries to gain sustainable competitive advantage. In order to provide organizations with a better perspective on the relationship between TQM and innovation performance, this paper aims to examine whether the application of TQM practices allows organizations, in particular, the ISO 9001:2000 certified manufacturing organizations within the Malaysian manufacturing industry, to build their competence and competitiveness through innovation. This study differs from existing studies because it focuses on the application of TQM practices in a developing economy, that is, Malaysia.

2. Literature review and formulation hypothesis

2.1. TQM practices

The global interest in implementing TQM implies that the principles and techniques of TQM are universal and practical across firms, industries and countries. For instance, the institutionalization of regional quality award (e.g., Minnesota Quality Award), national quality award (e.g., Australian National Quality Award) and international quality

award (e.g., European Foundation Quality Management Award) are events reflecting that TQM is universally applicable and valuable (Rungtusanatham *et al.* 1998). Theoretically, TQM is a management philosophy that can be described by its principles (i.e. customer focus, continuous improvement, and teamwork), practices, and techniques (Kanji 1998; Dean, Bowen 1994; Schonberger 1992).

The Malcolm Baldrige National Quality Award (MBNQA) framework has served as the basis model of TQM for many researchers (Jung, Wang 2006; Choi, Eboch 1998). The Malcolm Baldrige National Quality Improvement Act of 1987 set up an annual USA MBNQA which comprises criteria associated with TQM (Miranda 2003). These six criteria are leadership, strategic planning, customer focus, information analysis, people management, and process management (Prajogo, Hong 2008; Miranda 2003; Prajogo, Sohal 2003). These six elements of MBNQA have been accepted to represent TQM practices by many scholars such as Evans and Lindsay (1999), Dean and Bowen (1994). According to Samson and Terziovski (1999), numerous manufacturing firms in the United States, Europe, Australia as well as Japan have also adopted and implemented these six dimensions in their companies. Furthermore, these six elements of MBNQA could be used to review the quality improvement of any type or size of organizations (Hart, Schlesinger 1991).

Based on an extensive review of the past studies (e.g., Prajogo, Hong 2008; Prajogo, Sohal, 2003; Wilson, Collier 2000; Samson, Terziovski 1999; Choi, Eboch 1998), six constructs of TQM practices namely leadership, strategic planning, customer focus, information analysis, people management, and process management have been chosen to be analyzed in this study (see Table 1).

2.2. Innovation performance

Innovation is defined as “the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order” (Van de Ven 1986: 590). Innovation has long been known as one of the most significant sources of competitive advantage (Prajogo, Sohal 2006; Narver, Slater 1990). Apart from that, it has been acknowledged as an essential ingredient for firms’ long term success and survival (Ehigie, McAndrew 2005; Oldham, Cummings 1996; Scott, Bruce 1994). Earlier research have identified a wide range of benefits such as higher profits and market share, for business companies which have gained knowledge from the use of innovation strategies (Prajogo, Ahmed 2006; Narver, Slater 1990; Cooper 1993; Calantone *et al.* 1995; Griffin 1997; Han *et al.* 1998). According to Montes *et al.* (2003), innovating novel products and services can help to improve people’s lives, create a new market segment for the company, and new improvements in the production methods and tools. Pinho (2008) and Damanpour (1996) hypothesize that innovation involves undertaking activities to improve the products, processes or procedures, which can help to enhance the value and performance of products, processes or procedures. As proposed by Prajogo and Sohal (2001) and Cooper (1998), academics and practitioners have spent a lot of time searching and identifying organizational factors, practices and materials that can help to support and improve innovation. From a practical point of view, an organization which implements an integrated set of TQM practices could facilitate innovation performance.

Table 1. List of studies and dimensions of TQM

| TQM practices and performance measures | Description of TQM practices and performance measures | Supporting literature for TQM and performance measures |
|--|--|--|
| Leadership | Top management and supervisory commitment and leadership; public responsibility and citizenship | Flynn <i>et al.</i> (1994), Powell (1995), Wilson and Collier (2000), Prajogo and Sohal (2001), Sun and Cheng (2002) |
| Strategic Planning | Quality mission, goals and policy; strategy development and deployment | Prajogo and Sohal (2001), Raghunathan <i>et al.</i> (1997), Solis <i>et al.</i> (2000), Sun and Cheng (2002) |
| Customer Focus | Customer and market knowledge; attention to innovation performance; management of customer relationship | Powell (1995), Ahire <i>et al.</i> (1996), Adam <i>et al.</i> (1997), Solis <i>et al.</i> (2000), Sun and Cheng (2002), Prajogo and Sohal (2003) |
| Information Analysis | Performance measurement and analysis; information management; use of information technology; quality tools; benchmarking | Powell (1995), Samson and Terziovski (1999), Prajogo and Sohal (2001), Wilson and Collier (2000), Solis <i>et al.</i> (2000), Sun and Cheng (2002) |
| People Management | Employee involvement; employee empowerment; teamwork; rewards, recognition and performance appraisal; employee training | Flynn <i>et al.</i> (1994), Samson and Terziovski (1999), Wilson and Collier (2000), Sun and Cheng (2002) |
| Process Management | Product and service design; process control; innovation and continuous improvement of processes, products and services | Saraph <i>et al.</i> (1989), Flynn <i>et al.</i> (1994), Powell (1995), Anderson <i>et al.</i> (1995), Samson and Terziovski (1999), Wilson and Collier (2000), Sun and Cheng (2002) |

Source: Adapted from Sila (2007)

Kirner *et al.* (2009) stated that innovation can be classified into two types, namely, product innovation and process innovation. Within the context of manufacturing firms, product innovation covers either physical or intangible products, and process innovation includes technological or organizational aspects (Kirner *et al.* 2009). Innovation performance is thus measured using three process innovation indicators: the production lead time, the employee productivity, and the rework or scrap rate (Kirner *et al.* 2009). The measures of product innovation performance include the share of sales of products or services launched in the last three years (Kirner *et al.* 2009). On the other hand, Mankin (2007) also suggested that the innovation performance can be assessed using four measures: (1) Amount of ideas funded; (2) Return on investment or project net present value; (3) Innovators in higher positions/CEO devotion; and (4) Long-term customer adoption. Since innovation is relatively complex, Mankin (2007) emphasized

that each measure by itself is not able to capture the overall progress of innovation performance in an organization. Instead, the present study measures innovation performance through different aspects covering the results-based measure, process measures and project measures.

2.3. TQM practices and innovation performance relationship

2.3.1. Leadership

Leadership is the behaviour linked with the action of leading (Kanji 2008) and it is the force that “sow the seeds”, in which leaders act as mediators who promote and communicate the new ideology (Savolainen 2000). Top management leadership is viewed as the primary element of quality performance (Ravichandran, Rai 2000), especially top management attitudes and behaviour are related to quality management practices in a firm (Flynn *et al.* 1994). In general, it is argued that leadership in an organization is vital for the culture of innovation, in which all employees should be empowered to make decisions, execute programs and use their creative ability (Rahman 2002).

Leadership style has been highlighted as one of the most significant influences on firm's innovation performance because the leaders can choose to launch new ideas directly into a technological organization, set precise goals, and promote innovation initiatives among its subordinates (Garcia-Morales *et al.* 2008; Kanter 1983; Senge *et al.* 1994). Another significant leadership role that is linked to innovation is to cultivate a ‘fertile’ ground that can foster innovation (Prajogo, Ahmed 2006; Martensen 1998; Jassawalla, Sashittal 2002). According to Ahmed (1998), it is the duty of leaders to present a culture and an environment that are able to cultivate and acknowledge innovation at every level. Therefore, firms should launch more “innovation champion(s)” that will help the company develop initiatives and build up leaders in innovation projects (Prajogo *et al.* 2007). Based on this discussion, a link is formed between leadership and innovation performance. The following hypothesis is proposed:

H1: Leadership is significantly and positively associated with innovation performance.

2.3.2. Strategic planning

Strategic planning is generally viewed as a management function which involves the resources allocation of planned activities that have been calculated to accomplish business goals (Gray 1986; Lisinski, Saruckij 2006). Strategic planning is used to guide the organization to stay focus on the chosen objectives (Choi, Eboch 1998).

Studies conducted by Carayannis *et al.* (2000) and Grant (1996) have indicated that a firm's competitiveness comes from the employees' specialised knowledge, the ability of the firm to create new knowledge and to innovate, and the strategic actions enabled by innovation. Martin and Horne (1993) and Maidique and Zirger (1984) stated that a well designed and co-ordinated process are more likely to guarantee a greater success for the new product. As innovative strategies and plans are being formulated, communicating these to all employees involved is seen to be important and crucial (Martensen, Dahlgard 1999). A complete business strategy should incorporate a systematic plan for

new products, connect the new product to the corporate goals, determine which market and technology to select as well as what transmission criteria to apply (Martensen, Dahlgaard 1999; Cooper 1993). However, Cottam *et al.* (2001) found that several organizations were confused about how to “fit” innovation into their organizations’ overall business strategy and into their day-to-day working life. Drew (2006) and Mintzberg (1994) also highlighted that strategic planning is often criticized for having low levels of creativity and innovation. Therefore, Liedtka (2000) and Lorange (1980) argued that strategic planning should be aimed towards achieving a sufficient process of innovation that enables changes in the organization. Based on the above discussion, the following hypothesis is presented:

H2: Strategic planning is significantly and positively associated with innovation performance.

2.3.3. Customer focus

The overall planning and execution of quality programme must include the component of customer focus (Fuentes-Fuentes *et al.* 2004; Puffer, McCarthy 1996). One aspect of customer focus is to maintain a close relationship with the customers (Flynn *et al.* 1994). In order to identify customer needs and expectations, an organization must develop products and services that meet or exceed these expectations (Westphal *et al.* 1997; Flynn *et al.* 1994). The character of customer focus in motivating innovation has been discussed extensively in past literature (Abrunhosa, Sa 2008). This generates the impetus for companies to be innovative in order to meet customer needs through developing and initiating new products or services (Hoang *et al.* 2006). Specifically, from a company’s perceptive, innovation provides an opportunity to improve its relationship with customers in the sense that it could drive the customers’ current needs before being ordered by the customers in developing new products (Prajogo, Sohal 2004a, 2004b).

Being innovative helps to create a value among customers and thus improve performance of the firm with the objective to achieve a sustainable competitive advantage over its competitors (Mele, Colurcio 2006). In line with this, Jong and Hartog (2007) and Cooper (2003) stated that at a firm’s level, innovation research has shown that customers’ feedback can help to increase the success rate of new products in the market. As discussed above, customer focus is imperative for innovation performance, thus the following hypothesis is presented.

H3: Customer focus is significantly and positively associated with innovation performance.

2.3.4. Information analysis

Taylor and Wright (2003) stated that many researchers agreed that data and information should be at the heart of any TQM program. Data and analysis are used to make decisions in order to improve quality and productivity (Choi, Eboch 1998). Garvin (1983) posited that quality improvements are unlikely to take place without specific and timely information on defects and field failures. Information is important for firms to improve and enhance their innovation process, especially for firms that operate in

the technology-based arena and which struggle to survive in the current competitive marketplace (Lemos, Porto 1998).

Geffen and Rothenberg (2000) and Cohen and Levinthal (1990) argued that it is important for firms to be able to identify new external information, absorb it and apply it in determining innovation capabilities. Furthermore, Krogh *et al.* (2001) also stated that existing customer information, customer group, data about original technologies, new manufacturing procedures etc. shall be integrated by the organizations in order to create incremental innovations. However, the activities to increase the understanding levels of the economic impact of innovation performance have been held back by the lack of continual widespread information on various factors contributing to innovation (Loof, Heshmati 2002). As a result, information must be the blood that enables innovative firms to survive (Lemos, Porto 1998). Therefore, the following hypothesis is developed:

H4: Information analysis is significantly and positively associated with innovation performance.

2.3.5. People management

People are considered as the most vital asset in today's knowledge-based economy (Fang 2005; Karnitis 2006) as people resource is one element that competitors cannot imitate (Rahman 2002). Employee's involvement is a vital part of any TQM effort, and the MBNQA has emphasized the importance of human resources (Bowen, Lawler III 1992) in their model. By using the term "people", rather than human resource, the present study includes more practices to those beyond the human resource function such as upward and downward communication, reward systems, work design and culture (Wright *et al.* 2001).

Employees from all levels of the organization should be encouraged to be involved in the innovation process of the company. This will enhance the innovation in the organizations, given that innovation mainly originates from people's efforts to interact with each other (Garcia-Morales *et al.* 2008; Hartman *et al.* 1994). In order to be innovative, every organization should maintain an environment that supports and encourages innovation. By doing so, the employees in the organization are not only 'willing' (i.e. motivated) to innovate, but 'can' (i.e. have opportunities) innovate as well (Prajogo, Ahmed 2006; Kanter 1983; Woodman *et al.* 1993; Claver *et al.* 1998). Based on the literature findings above, the following hypothesis has been formed.

H5: People management is significantly and positively associated with innovation performance.

2.3.6. Process management

Process management is a system of interrelated processes focusing on three initiatives: (1) mapping processes; (2) enhancing processes; and (3) adhering to documented organizational processes (Benner, Tushman 2003). For example, a good process management requires correctly defining and documenting process management procedures, with clear instructions for machine operation and setup placed at all workstation, in order to reduce the chances of operator error (Flynn *et al.* 1994).

As organizations achieve higher levels of process management, the measures of effectiveness are accentuated in the aspect of efficiency, speed and costs or waste reduction, which involve process management extending to innovation development (Benner, Tushman 2003). These dynamics, especially in the manufacturing industry, can have a substantial impact on an organization's innovation performance. In this regard, a hypothesis supporting a positive relationship between process management and innovation is proposed.

H6: Process management is significantly and positively associated with innovation performance.

3. Research methodology

This section discusses the sample and data collection procedures, and operational measures of variables used in the study as well as the statistical tests used to evaluate the multidimensionality of TQM practices and its relationship with innovation performance.

3.1. Sampling procedures

In this study, the target population is the managers from the manufacturing organizations that are certified with the ISO 9000 quality system series. These firms are taken from the list of Federation of Malaysian Manufacturers (FMM) Directory (2007). Representing over 2000 manufacturing and industrial service companies of various sizes, FMM is a trade organization in Malaysia (FMM Directory 2007). As FMM is a well-known and prominent representative of the manufacturing and service industries for over 38 years, the selected sample in this study is considered to be a valid representation of the population. The respondents of this study are managers who possessed sufficient knowledge of their organizational practices pertaining to quality management, and have great knowledge about the levels of innovation performance in their organizations.

The empirical data was collected using a questionnaire survey. A random sample of 620 managers was selected from the ISO 9001 certified Malaysian manufacturing organizations indexed in FMM directory. Only one questionnaire per organization was included in the sample. Of the 620 questionnaires originally distributed, 206 were returned with usable answers. This constitutes an overall response rate of 33%. The positions of the respondents in the organization are as follow: 63% of the respondents are production managers, operations managers and quality managers, 21% of them are senior managers such as general managers and managing directors and the remaining respondents are managers from other areas, such as human resource, finance, marketing and administration.

3.2. Research instrument

3.2.1. Independent variables: TQM practices

The independent variables in this study are based on the six dimensions of TQM adopted by Prajogo and Sohal (2003). The six dimensions are namely, leadership, customer focus, strategic planning, information analysis, process management and people management. Thus, a total of 37 statements are developed. In this study, sample questions

include “Top management actively participates in quality management and improvement process” (*leadership*), “Our organization has a comprehensive and structured planning process which regularly sets and reviews short and long-term goals” (*strategic planning*), “Our organization always conducts market research in order to collect suggestions for improving our products” (*customer focus*), “Our organization has the ability to monitor all production/services processes to improve quality” (*process management*), “Our organization has a company-wide training and development process for all our employees” (*people management*) and “Our organization has undertaken benchmarking of other firms’ product quality and procedures” (*Information analysis*). The statements are measured by a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

3.2.2. Dependent variable: innovation performance

The measures of innovation performance were derived and adapted from several studies (Prajogo, Sohal 2003; Hoang *et al.* 2006; Singh, Smith 2004). Nine statements are developed under this construct. Respondents (i.e. managers) are asked to indicate their opinions about the innovation performance level in their organizations based on the five-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). Some of the examples of the statements that measured innovation performance are as follows: “The updated-ness or novelty of technology used in process” (*process innovation*) and “The use of latest technological innovations in new product development” (*product innovation*).

3.3. Statistical analysis

Factor analysis was performed for the study variables. Reliability coefficients and intercorrelations were computed to determine the variability and interdependence of the subscales derived from the factor analyses (Ooi *et al.* 2006, 2008). Multiple regression analysis was then employed to examine the relationship between TQM practices and innovation performance.

4. Results of the survey

4.1. Goodness of measures

To ensure the reliability of data for both TQM practices and innovation performance, factor analysis and scale reliability analysis were used. Table 2 and 3 show the results of the factor analysis and reliability analysis. All individual loadings are above the minimum of 0.5 recommended by Hair *et al.* (1998). To examine the internal consistency of the measurement model, composite reliability is utilized. This is because it is similar to that of Cronbach’s alpha “except that it also takes into account the actual factor loadings rather than assuming that each item is equally weighted in the composite load determination” (Lin, Lee 2004: 116). In addition, Chau and Hu (2001: 709) further confirm that by using the formula: “(Square of the summation of the factor loadings) / {(Square of the summation of the factor loadings + (summation of error variances))}”, we can calculate the construct reliability. According to Molina *et al.* (2007), the minimum proposed value for reliability is 0.70. As shown in Table 2, based on the above reasoning,

the scales are all within the acceptable limits. Furthermore, the composite reliabilities of all latent constructs have also exceeded the benchmark of 0.7 as suggested by Nunnally and Bernstein (1994). This implies that the measurement is good thus the model being applied in this study is valid within reasonable statistical conditions.

Table 2. Factor analysis of TQM practices

| Construct | Loadings | Eigenvalue | Variance | Reliability | Scale Composite Reliability (SCR)** |
|--|----------|------------|----------|-------------|-------------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Leadership (LD) | | | | | |
| Top management actively participates in quality management and improvement process (LD1) | 0.815 | 2.496 | 49.918 | 0.832 | 0.832 |
| Top management strongly encourages employee involvement in quality management and improvement activities (LD3) | 0.735 | | | | |
| Top management learns quality-related concepts and skills (LD2) | 0.669 | | | | |
| Top management discusses many quality-related issues in top management meetings (LD6) | 0.657 | | | | |
| Top management pursues long-term business success (LD7) | 0.647 | | | | |
| Strategic Planning (SP) | | | | | |
| Our organization has a comprehensive and structured planning process which regularly sets and reviews short and long-term goals (SP2) | 0.744 | 2.394 | 47.889 | 0.821 | 0.823 |
| Inclusion of continuous quality improvements in planning process (SP6) | 0.736 | | | | |
| Our organization always incorporates supplier capabilities, and needs of other stakeholders including the community when we develop our plans, policies and objectives (SP3) | 0.675 | | | | |
| Our organization has a mission statement which has been communicated throughout the company and is supported by our employees (SP1) | 0.663 | | | | |
| Believe that strategic plans (and tactical plans) are linked to quality values (SP5) | 0.648 | | | | |
| Customer Focus (CF) | | | | | |
| Quality-related customer complaints are treated with top priority (CF2) | 0.787 | 3.306 | 55.101 | 0.884 | 0.880 |
| Our organization conducts a customer satisfaction survey every year (CF3) | 0.763 | | | | |

Continue of Table 2

| | 1 | 2 | 3 | 4 | 5 | 6 |
|--|-------|-------|--------|-------|-------|---|
| Our organization has been customer focused for a long time (CF6) | 0.747 | | | | | |
| Our organization always conducts market research in order to collect suggestions for improving our products (CF4) | 0.746 | | | | | |
| Our organization has precise knowledge of customer expectations (CF7) | 0.724 | | | | | |
| Our organization collects extensive complaint information from customers (CF1) | 0.683 | | | | | |
| People Management (HR) | | | | | | |
| Employee satisfaction is formally and regularly measured (HR3) | 0.831 | 4.080 | 58.281 | 0.905 | 0.907 | |
| Reward and recognition system within the company rewards relationship and task accomplishments based on work quality (HR7) | 0.821 | | | | | |
| Our organization has a company-wide training and development process for all our employees (HR1) | 0.785 | | | | | |
| Employee flexibility, multi-skilling and training are actively used to support performance improvement (HR4) | 0.770 | | | | | |
| Our organization has maintained both “top-down” and “bottom-up” communication processes (HR2) | 0.759 | | | | | |
| Our organization’s compensations system encourages team and individual contributions (HR6) | 0.730 | | | | | |
| Our organization maintains a work environment that contributes to the health, safety and well-being of all employees (HR5) | 0.631 | | | | | |
| Process Management (PM) | | | | | | |
| Our organization had at least one product/service improvement in the past 1 year (PM6) | 0.763 | 3.613 | 51.610 | 0.888 | 0.882 | |
| Employees are encouraged to develop new and innovative ways for better performance (PM2) | 0.750 | | | | | |
| Use of statistical process control to monitor production/service processes (PM8) | 0.713 | | | | | |
| Employees understand respective role (PM3) | 0.709 | | | | | |
| Employees work as team but guided by clear goals (PM1) | 0.707 | | | | | |
| Our organization has the ability to monitor all production/services processes to improve quality (PM7) | 0.697 | | | | | |
| Our organization has knowledge of lost customers and investigates reason (PM4) | 0.687 | | | | | |

End of Table 2

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|-------|-------|--------|-------|-------|
| Information Analysis (IA) | | | | | | |
| Regular reviews on organization's quality performance (IA1) | | 0.801 | 3.873 | 55.332 | 0.895 | 0.896 |
| Availability of key performance figures for analysis and decision making (IA4) | | 0.788 | | | | |
| Our organization analyzes all work processes and systems (IA3) | | 0.767 | | | | |
| Our organization has undertaken benchmarking of other firms' product quality and procedures (IA7) | | 0.738 | | | | |
| Availability of regular strategic planning (IA5) | | 0.708 | | | | |
| Knowledge, availability, access and collection of data (IA2) | | 0.700 | | | | |
| Our organization has undertaken benchmarking relative to cost position (IA6) | | 0.698 | | | | |

Note: Items SP4, SP7, LD4, LD5, PM5 and CF5 were deleted due to low factor loadings.
 **SCR = $(\sum \lambda_i^2) / [(\sum \lambda_i^2) + \sum \delta_i]$, (λ_i = standardized factor loadings, i = observed variables, δ_i = error variance)

Table 3. Factor analysis of innovation performance

| Innovation Performance | Loadings | Eigenvalue | Variance | Reliability | Scale Composite Reliability (SCR)** |
|--|----------|------------|----------|-------------|-------------------------------------|
| The level of newness (novelty) of new products (IP8) | 0.845 | 4.975 | 55.822 | 0.916 | 0.917 |
| The use of latest technological innovations in new product development (IP6) | 0.811 | | | | |
| The speed of new product development (IP7) | 0.773 | | | | |
| The number of new products introduced to the market (IP3) | 0.745 | | | | |
| The number of new products that is first-to-market (early market entrants) (IP5) | 0.743 | | | | |
| The technological competitiveness (IP9) | 0.727 | | | | |
| The updated-ness or novelty of technology used in process (IP1) | 0.703 | | | | |
| The speed of adoption of the latest technological innovations in process (IP4) | 0.680 | | | | |
| The rate of change in processes, techniques and technology (IP2) | 0.643 | | | | |

Note: **SCR = $(\sum \lambda_i^2) / [(\sum \lambda_i^2) + \sum \delta_i]$, (λ_i = standardized factor loadings, i = observed variables, δ_i = error variance)

4.2. Correlation analysis: relationships between independent variables

The correlation matrix in Table 4 indicates correlation coefficients between the independent variables in this research. The correlation coefficient indicates the strength of the link between the variables. A correlation is considered significant if the *p*-value is less than 0.01. There is a significant correlation between all the independent variables as listed in Table 4.

Out of 15 correlations, all the *r*-values presented in Table 4 are less than 0.9. Hair *et al.* (1998) suggested that to ensure non-existence of multi-collinearity, the correlation value should not exceed 0.90. As shown in Table 4, the highest value of coefficient is 0.851 (process management with people management) which is smaller than 0.90. Hence, no multicollinearity was found in this present study.

Table 4. Correlation analysis: relationship between independent variables

| | LD | SP | CF | HR | PM | IA |
|----|---------|---------|---------|---------|---------|-------|
| LD | 1.000 | | | | | |
| SP | 0.747** | 1.000 | | | | |
| CF | 0.636** | 0.700** | 1.000 | | | |
| HR | 0.696** | 0.815** | 0.778** | 1.000 | | |
| PM | 0.669** | 0.776** | 0.823** | 0.851** | 1.000 | |
| IA | 0.601** | 0.745** | 0.754** | 0.745** | 0.735** | 1.000 |

Note: ***p* < 0.01; N = 206; LD = leadership; SP = strategic planning; CF = customer focus; HR = people management; PM = process management; IA = information analysis

4.3. Multiple regression analysis

To examine the association between TQM dimensions and innovation performance, we have chosen to use multiple linear regression analysis. According to Hair *et al.* (1998), it is a practical statistical tool that examines the linkages between a set of independent variable with one dependent variable.

In this study, a six-predictor multiple linear regression model was proposed. The six-predictor variables are leadership (X_1), strategic planning (X_2), customer focus (X_3), process management (X_4), information analysis (X_5), and people management (X_6). The equation of the proposed multiple linear regression model is illustrated as follows:

$$Y (P1) = b_0 + b_1 (X_1) + b_2 (X_2) + b_3 (X_3) + b_4 (X_4) + b_5 (X_5) + b_6 (X_6) + e,$$

where: $Y (P1)$ = Dependent variable (innovation performance), b_0 = Constant, e = Error

In relation to the sample size, the estimated parameter ratio of 15:1 to 20:1 is sufficient to achieve a meaningful estimation of sample size (Hair *et al.* 1998). In this study, the sample size to the estimated parameter ratio is 34.33:1. According to Hair *et al.* (1998), it can thus be assumed that sample size in this study is sufficient and adequate.

Based on this method, the six main independent variables (TQM practices) and dependent variable (innovation performance) were entered together. Table 5 shows the detail of the regression output. As stated by Hair *et al.* (1998), tolerance indicator needs to be greater than 0.1 and variation inflation factors (VIF) more than 10 to avoid the occurrence of multicollinearity. The VIF and tolerance value presented in Table 5 shows that there is no multicollinearity problem as the tolerance values of more than 0.1 and the VIF values ranged from 2.445 to 5.003, which are less than 10 (Hair *et al.* 1998).

Table 5. Regression analysis of TQM practices on innovation performance

| | Unstandardized Coefficients | | Standardized Coefficients | | Collinearity Statistics | |
|----------------------------|-----------------------------|-------|---------------------------|---------|-------------------------|-------|
| | B | S. E. | β | p | Tolerance | VIF |
| (Constant) | 0.341 | 0.108 | | 0.002 | | |
| Leadership | 0.076 | 0.041 | 0.080 | 0.062 | 0.409 | 2.445 |
| Strategic Planning | 0.131 | 0.053 | 0.138 | 0.014* | 0.239 | 4.187 |
| Customer Focus | 0.100 | 0.047 | 0.113 | 0.035* | 0.264 | 3.792 |
| Information Analysis | -0.013 | 0.041 | -0.015 | 0.754 | 0.331 | 3.025 |
| Process Management | 0.676 | 0.057 | 0.722 | 0.000** | 0.200 | 5.003 |
| People Management | 0.187 | 0.060 | 0.190 | 0.002** | 0.201 | 4.970 |
| <i>R</i> | 0.923 | | | | | |
| <i>R</i> ² | 0.851 | | | | | |
| F-statistic | 190.096 <i>p</i> < 0.001 | | | | | |
| Adj. <i>R</i> ² | 0.847 | | | | | |
| N | 206 | | | | | |

Note: **p* < 0.05; ***p* < 0.01

From Table 5, it can be observed that the coefficient of determination (*R*²) is 0.851, representing that 85.1% of innovation performance can be explained by the six independent variables (TQM practices). The proposed model is adequate as the F-statistic = 190.096 (*p*-value = 0.000) is significant at the 1% level (*p* < 0.01). This indicates that the overall model is reasonable fit and there is a statistically significant relationship between TQM practices and innovation performance. The individual model variables reveal that process management, ($\beta = 0.722$, *p* < 0.01), strategic planning ($\beta = 0.138$, *p* < 0.05), customer focus ($\beta = 0.113$, *p* < 0.05), and people management ($\beta = 0.190$, *p* < 0.01) are found to have a significant and positive relationship with innovation performance. Therefore, the hypotheses H2, H3, H5 and H6 are supported. Meanwhile, leadership ($\beta = 0.080$, *p* > 0.05) and information analysis ($\beta = -0.015$, *p* > 0.05) has no significant association with innovation performance. However, these practices have bestowed long-term, infrastructural benefits necessary for the continued development over time, but with an indirect association towards innovation performance. Hence, H1 and H4 are not supported.

5. Discussion

The results of the multiple regression analysis imply that TQM has a significant and positive relationship with innovation performance. Our findings show only four dimensions of TQM, (i.e. process management, strategic planning, people management and customer focus) have to a certain degree, a positive impact on innovation performance of companies surveyed in Malaysia. Our findings also show that leadership and information analysis has an insignificant relationship with innovation performance. This research supports the findings of Singh and Smith (2004), whereby their result obtained could not confirm that all TQM factors have an impact on innovation.

5.1. Leadership

The result reveals that leadership is found to be insignificant to enhance the level of innovation performance. This result implies that leadership does not play a major role in innovation from the survey in the Malaysia context. This is contrary to the findings from the literature review, for example; Hoang *et al.* (2006) in which they concluded that leadership portrays a positive impact on Vietnamese firms' innovation performance in terms of the levels of newness by providing the reason that a supportive management ensures the success of TQM implementation. The findings of this study indicate that the management has yet to provide sufficient leadership in promoting the importance of innovation. This stresses on the need of top management commitment to TQM implementation in order to promote innovation performance within the manufacturing context. As senior management has the power to allocate resources within the organization, it is important for the top management to communicate with the employees and cultivate the innovation culture in the Malaysian manufacturing sector. For example, the top management of the manufacturing organizations in Malaysia shall seek global R&D partnership and innovation collaboration as a way to develop their core competencies and nurture the innovative culture among the employees.

5.2. Strategic planning

The study found that strategic planning shows significant relationship with innovation performance. This implies that the formulation and execution of strategic planning in the manufacturing organizations in Malaysia could improve innovation performance. This result is supported with the findings of Zhang (2000) in which he concluded that vision and statement (i.e. part of the process of strategic planning) have positive relationship with innovation performance. Strategic planning deals with vision and mission mapping as well as cultivation of organizational culture. From the TQM perspective, "quality vision statement" could be used to communicate quality policy. An effective quality vision statement usually entails with clauses that can inspire employees to high levels of performance, and further, to fostering their commitment to TQM (Zhang 2000). Consequently, innovation performance could be enhanced through superior quality services provided by dedicated employees who are guided by a shared vision. Therefore, a good strategic quality planning should be charted by leaders of the organizations to achieve organizational goals that support quality management which in return, will lead to focused innovation performance.

5.3. Customer focus

From this research, customer focus is reported to have a significant positive relationship with innovation performance within the Malaysian manufacturing sector. Our research findings are in line with the findings of Hoang *et al.* (2006), in which their research confirms that by focusing on the customers' existing and future expectations, firms will improve on their products and services through innovation to achieve greater customer satisfaction. Furthermore, this result is consistent with Lorente *et al.* (1999)'s argument, in which they posited that as current and future customers' needs are being identified, business innovation will be inspired. However, some researchers found no positive relationship between customer focus and the firm's innovation performance. It is said that being customer centered is not related with product newness (Atuahene-Gima 1996 as cited by Hoang *et al.* 2006). Furthermore, Prajogo and Sohal (2003) argued that by attending to the direct customers' wants and needs, the company will be confined to satisfying the existing customers' standard requirements alone, creating hindrance towards being innovative. This was also confirmed by Slater and Narver (1998). Prajogo and Sohal (2001) proposed that being customer focused prevents companies from being broad-minded, restraining the firm's ability to innovate, thus preventing firms from becoming industry leaders.

5.4. Information analysis

The dimension of information analysis is found to be insignificant to innovation performance. This result is consistent with the findings of Hoang *et al.* (2006), which confirms the earlier findings of Gustafson and Hundt (1995) and McAdam *et al.* (1998). Information analysis is the process of analyzing information and searching for ways to reduce differences that original thinking and innovation have been formed and hence a negative relationship exists between information analysis and innovation performance. In this respect, manufacturing organizations in Malaysia have set production efficiency as the main purpose when using information analysis as a control and confirm to the standard rather than using it as a tool for innovation.

5.5. People management

The statistical result obtained from this study reveals that people management is found to be positively associated with the levels of innovation performance of a firm. This result is consistent with the comments given by Lorente *et al.* (1999) in that well-trained employees are more open to accept changes in new systems and operations. This is because through the various training programs provided, the employees' skills are expected to improve and new knowledge is to be acquired. From the discussion, with improved performance, employees should also be duly rewarded especially if they are able to innovate in order to motivate them further.

Training is essential as it changes the attitudes and perspective of employees towards any organizational changes. With a supportive organizational atmosphere, this helps to create a sense of empowerment among employees. According to Lorente *et al.* (1999), empowered employees are more inclined to continuous improvement when they are involved in

the change process. This could be due to the fact that employees' morale and confidence are elevated when training is provided, employees are more receptive to change, which will determine the success of organizational innovation (Prajogo, Sohal 2001).

5.6. Process management

The results in this study demonstrate favorably that process management is found to be significant and contribute to the enhancement of innovation within the Malaysian manufacturing sector. This result provides supporting evidence from the findings of Prajogo and Sohal (2003) in which there was a link between process management and innovation was being studied for a large manufacturing firm in Australia. Analysis of the research findings suggests that as the company adopts stricter quality systems and standard into its production process itself (due to pressure from its customer and the industry itself to achieve high quality performance), the company started to apply new technologies into its manufacturing processes. As more investment was being made to purchase the advanced equipment for automation, this enables the company to achieve a higher level of process capability. As a result, the manufacturing firm is required to come up with a new set of products, coupled with built in features, commensurate with the level of automation. This proves that processes can dictate the design features of a product; hence a positive relationship exists between product innovation and process innovation. This is further confirmed by Lorente *et al.* (1999)'s findings where they concluded that companies that adopt TQM practices are more receptive to accept management innovation.

6. Research implications

In this study, a current research in the area of TQM has been revisited and implications in both theoretical and managerial perspectives have been found. These implications are discussed in the next section.

6.1. Theoretical implications

From the theoretical perspectives, this study provides a better perception on the six TQM dimensions and their importance towards increasing innovation performance within the manufacturing context. It is believed that this study can fill in the current knowledge gap in connection to the linkages between the practices of TQM with innovation performance. The theoretical framework that was developed emphasized on those TQM elements that are particularly essential in determining a high level of innovation performance among the manufacturing firms. Moreover, there are very limited empirical studies that examine the multidimensionality of TQM principles which smooth the progress of the level of innovation performance within a manufacturing setting, particularly in a developing country such as Malaysia. With the present findings, it is believed to assist the manufacturing firms in increasing their levels of innovation activities. Apart from that, with its relatively new concept, the empirical research may also capture the attention of other researchers in seeking out to find the right circumstances that are most conducive to the establishment of innovation performance, particularly in the domain of TQM.

6.2. Managerial implications

Practically, this study reveals that customer focus, strategic planning, people management and process management are positively associated with innovation performance. Therefore, in Malaysia's manufacturing context, to promote innovation, the management might want to look into these four TQM practices which are seen to be vital links.

Firstly, it is suggested that with the positive relationship between customer focus and innovation performance, organizations ought to set up clear customer focus strategy such as with proper customer relationship management system, customer feedback system and customer care system. Next, strategic planning encompasses setting the direction of the company; the respondents are of the opinion that strategic planning would have a positive relationship with innovation performance; therefore it is suggested the organizations should establish the strategic planning and setting the direction of the organization clearly for innovation performance. Thirdly, people management is seen to have a positive relationship with innovation performance. Practices of people management such as training and development, teamwork, appropriate delegation are some of the key steps from the people management. Managers are advised to weight into for better innovation performance. Last but not least, process management is also seen to be related to the innovation performance. This finding might be attributed to the scenario where Malaysian manufacturing sectors are seen to be a strong contender in terms of third party contract manufacturing roles for the multi national firms instead of own brand building and own product development. Therefore, to be competitive in the business environment, good process management is seen to be related to innovation performance.

Whereas for the investigation on two other TQM practices, leadership and information analysis; are not perceived to be of strong relationship with the innovation performance. Perhaps, the management needs to adopt a more liberal approach in promoting innovation performance since the respondents is of the opinion that leadership does not have a strong relationship with it. At the same time, the respondents also see lesser relationship between information analysis and innovation performance. This might be the perception of the role of information analysis are viewed as the supporting function in the manufacturing context which emphasized more on production efficiency in Malaysia (i.e. mainly contract manufacturing or off-shoot of MNCs) instead of playing the leading role in an organization.

7. Research limitations and future research

In order to determine possible future research opportunities, several limitations of this study should be noted. Firstly, the time sequence of the relationships between the variables could not be determined since cross-sectional data were used. Thus, the findings of this study should not be taken as proof of the causal relationships. It is recommended that longitudinal research designs should be applied to provide the evidence of causality that is not obtainable through the designs of cross-sectional studies.

Secondly, this study was confined only to the manufacturing industry in Malaysia. It is suggested that future research should cover both manufacturing and service industries.

In essence, both industries are different: service industry depends heavily on people to produce services while manufacturing industry focuses on producing physical products. Thus, both industries may need different management practices and quality improvement programs. A comparison could be made in terms of the relationships between the types of organization and TQM practices among these two industries. It is also essential to also take note that the background of the companies under investigation is also not included in this present study. Hence, it would be beneficial if future research can conduct a detail breakdown of the companies' background as well as their life cycle stages, so that a further analysis and discussion can be conducted.

Thirdly, despite its cost-effectiveness and sample coverage (i.e. larger samples are collected compared with the interviews method), questionnaire survey may suffer from response bias and lack of respondent awareness. It is suggested that further analysis may be needed to explore and expand the research through field observations and interviews of managers from the sample. Finally, since the constructs of customer focus, process management, strategic planning and people management are reported to have significant positive relationship with innovation performance, future research might explore the robustness of these associations. For instance, the researchers might examine to what extent these four significant dimensions enhance innovation performance. Likewise, the exploration of the robustness of these associations would have made the results more reliable.

Furthermore, apart from the six TQM practices, other factors that can affect innovation performance were not taken into consideration. One such factor will be motivation from regulatory requirements. Regulations from environmental groups as well as the government to control the activities of the firms can indeed motivate a company to become more creative, generating newer ideas and developing more eco friendly products that lessen environmental pollution. As such, it can be expected that such factor can have a strong linkage with innovation performance.

Lastly, although this study has appropriately employed multiple regression analysis which analyzes the relationship between a single dependent variable (i.e. innovation performance) and several independent variables (i.e. TQM practices), future studies could use other multivariate technique such as structural equation modeling (SEM) which has the ability to incorporate unobserved constructs in the relationships and account for measurement errors in the analysis.

8. Conclusion

From the study presented, we have identified four TQM constructs that are having significant relationships with innovation performance namely strategic planning, customer focus, people management and process management. We have further identified two constructs that are found not to have significant relationship with innovation performance, i.e. leadership and, information analysis. Both of these findings are in the context of Malaysian manufacturing companies. Innovation performance and to be innovative no doubt are critical to the ability to be competitive in the market place. Malaysian

companies are not known to be innovative as its economy is still at the developing stage. Furthermore, the uniqueness in the Malaysian development model thus far has been relying on low value foreign labour input to a great extent. With the reliance on low value foreign labour input, it is believed by many quarters that this development strategy has stifled the innovation performance and process of up the value chain development among the industrialists in Malaysia. Therefore, it was not really a surprise that leadership was seen to be lacking in innovation performance from this study.

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