

TQM practices and knowledge sharing: An empirical study of Malaysia's manufacturing organizations

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Abstract The purpose of this paper is to examine the multidimensionality of TQM practices and its relationship with knowledge sharing as perceived by middle management employees in Malaysia's ISO 9001:2000 certified firms of manufacturing sectors. The data which were collected from a survey of 129 middle management employees in Malaysia were used to test the proposed research framework. Furthermore, confirmatory factor analysis was performed to evaluate the reliability and validity of the measurement model, and the structural analysis was used to examine the research framework. The analytical results revealed that training and development, customer focus, and teamwork showed a positive association with middle management employees' knowledge sharing. This analysis is vital for senior managers of TQM companies that want to establish a knowledge sharing capability. Senior managers could focus their efforts on implementing TQM practices for building competitive knowledge sharing competencies.

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Over the past decades, Total quality management (TQM) has been considered as an essential element in organizations that was instrumental in increasing their competitive advantage and overall performance towards achieving world-class status (Lakhe & Mohanty, 1995; Zhang, 2000). The function of TQM is extensively recognized as being a critical determinant in the success and survival of any organization, whether in manufacturing or service industries (Demirbag, Koh, Tatoglu, & Zaim, 2006). Previous empirical research has confirmed that the effective implementation of TQM can lead to improvements in organizational performances (see for examples: Prajogo & Sohal, 2003; Samson & Terziovski, 1999).

Despite the significant body of TQM literature that has evolved to examine the relationship between the perspective and organizational performance as mentioned in the section above, there is lack of systematic empirical evidence regarding the extent of TQM practices and its effect on knowledge sharing behavior in the manufacturing sector in general, and in the Malaysian manufacturing sector in particular. The manufacturing sector represents about 30.1 per cent of Malaysia's gross domestic product (GDP) and is a very vital mechanism of its economy (Ministry of International Trade and Industry, 2007: 7). A well-managed TQM program and a knowledge sharing culture are important for the manufacturing industry to maintain its competitiveness. In order to provide the organizations with practical assistance in dealing with TQM and its association with knowledge sharing, this paper uses ISO 9001:2000 certified organizations within the Malaysian manufacturing sector to examine whether the application of TQM practices result in an improvement of middle management employees' knowledge sharing.

Given the above reasons, this paper presents an empirical study where the main objective is to examine the relationship between TQM practices with knowledge sharing as perceived by middle management employees in the Malaysian ISO 9001:2000 certified manufacturing firms. The remainder of this research paper is structured as follows: In the next section, the literature of TQM practices, the theory of knowledge sharing, and the link between TQM practices and knowledge sharing are reviewed. In the following section, the research framework is proposed. The next section provides the details concerning the research instrument and data used in this study. Finally, the results are discussed followed by research limitations of the study, conclusions, both theoretical and managerial implications, as well as recommendation for future research.

Literature review and hypothesis formulation

TQM practices

TQM is defined as a holistic management approach that aims to achieve organizational objectives and fulfill customer needs by integrating every organizational function (Kumar, Choisine, de Grosbois, & Kumar, 2009). According to Yong and Wilkinson (2001), the core concepts of TQM can be structured into two aspects, namely, the "hard"

aspect (i.e., statistical methods, systems tools and performance evaluation), and “soft” aspect (i.e., training and employee recognition, teamwork). Since the recent literature of TQM greatly focuses on the “soft” aspect, the concept of TQM in this study is also centered on the soft aspect, namely, customer focus, leadership, training and development, teamwork, and organizational culture (for examples see: Dale, 1999; Reed, Lemak, & Mero, 2000; Shenawy, Baker, & Lemak, 2007; Sila & Ebrahimpour, 2002).

It is a given that the successful pursuit of customer needs and satisfaction yields high quality. In this regard, the dimension of customer focus is important to give employees of all levels a common language for continuous improvement. In Deming’s discussion of 14 Points (Deming, 1985: 7), the role of leaders has been emphasized through point number 1: “the constancy of purpose to plan product and service that will have a market and keep the company in business, and provide jobs.” This notion is further supported by Reed and colleagues (2000), in which the implementation of TQM will not work without the commitment of top management in their focus on quality. Although much has been said about the role of top management, the success of TQM programs is highly dependent on whether both management and staff are provided additional training and education about the quality concepts and initiatives (e.g., the use of quality tools and techniques). In reality, a team-oriented environment is needed to facilitate problem-solving in quality matters at different organizational levels in the organization. Similarly, the implementation of TQM requires major organizational culture changes, in which all employees shall place a premium on quality issue.

On the basis of the TQM literature, five dimensions of soft TQM have been selected as the TQM practices for this study. These five dimensions are namely, customer focus, leadership, training and development, teamwork, and organizational culture. Furthermore, these five dimensions of TQM have previously been identified as those likely to reflect the relative impact on knowledge sharing (Ellinger & Bostrom, 1999; Molina, Llorens-Montes, & Ruiz-Moreno, 2007; O’Dell & Grayson, 1998; Stoddart, 2001).

Knowledge sharing

Knowledge is essential to all organizations. Knowledge is one of the keys, which affects the success of a business organization where its employees who have been equipped with the necessary and right type of information will give the organization a better competition advantage than its competitors (Han & Anantatmula, 2007). The information that an employee had or knew is known as knowledge. It is vital that proper training is provided to the employees who newly join the organizations so that they possess the relevant knowledge needed to perform their job. Apart from the provision of training, the concept of knowledge sharing is important for both the individuals and organizations. Knowledge sharing can be defined as the “dissemination of information and knowledge through the whole department and/or organization” (Yang, 2004: 2). Knowledge sharing is a process where knowledge and skills are transferred from one individual to another (Lin, 2007). Knowledge sharing behavior can be fostered at the individual level (Huang, Davison, & Gu, 2008) and effective knowledge sharing among organizational employees is useful to

increase the long term sustainable competitive advantage (Lin, 2007; Ruhi, 2003; Wang, 2009) of the company as it encourages creativity and innovation (Apostolou, Mentzas, & Abecker, 2008; Hong, Doll, Nahm, & Li, 2004). This creates a place that generates information for decision making (Kearns & Lederer, 2001). New knowledge will indirectly form while the old knowledge is shared through discussion, meetings, and informal chats (Fernie, Green, Weller, & Newcombe, 2003; Ho, 2009; Yang, Moon, & Rowley, 2009). Ruhi (2003) discovered a number of benefits on effective knowledge sharing which include, increased responsiveness to changes in the economic landscape, dynamic creation and application of custom content, and better managed business partner relationships. Additionally, a successful knowledge sharing environment will strategically change employee attitudes towards promoting willingness and reliability in sharing knowledge among employees (Connelly & Kelloway, 2003). As there are a myriad of benefits in knowledge sharing, motivational programs should be held frequently to encourage employees to share knowledge (Ardichvili, Page, & Wentling, 2002).

The link between TQM practices and knowledge sharing

Leadership Leadership in an organization can be defined as the ability of a role player to influence a team of employees to follow his or her instructions or missions in order to achieve the goals or objectives that have been preset by the company (Bounds, Yorks, Adams, & Ranney, 1994). Knowledge sharing in a firm does not occur automatically. Thus, a leader plays an important role to ensure that it materializes (Ellinger & Bostrom, 1999). The managerial ties of top managers are important to facilitate knowledge sharing in an organization (Gao, Xu, & Yang, 2008). According to MacNeil (2003), leadership in management could be a factor on the improvement of main expertise and skills via their facilitators role of organizational learning within their organizations, particularly by creating an atmosphere of knowledge sharing whereby the employees are encouraged to use their clear and unspoken knowledge to assist in problem-solving. Many studies confirm that the senior management always plays an important role in influencing the rate of success for knowledge sharing (e.g., Omerzel & Antoncic, 2008; Wong, 2006), and in enhancing the organizational knowledge of the process management (Bryant, 2003). Bryant (2003) continued to explain that the mission, motivation, systems, and formation design for all activities of the organization which present instrumental to exchange knowledge should come from the leadership of the management. The leaders should also sanction and encourage employees to take part in the process of decision making, and conduct meetings whereby every team member could express their ideas and suggestions freely (Arnold, Arad, Rhoades, & Drasgow, 2000). In this regard, the following hypothesis is proposed.

Hypothesis 1 Leadership has a significant positive association with knowledge sharing.

Organizational culture Gore Jr. (1999) stressed that an organizational culture is measured as the basis which heads toward the success of an organization. Generally, the culture of an organization could impact the behaviors of knowledge sharing with

the creation of an atmosphere whereby there are solid social standards regarding the significance of the willingness of one sharing his or her knowledge with others (Cabrera & Cabrera, 2002).

Culture is the set of shared history, expectations, unwritten rules, and social mores that influences individual behavior (Bose, 2004). Organizational culture is recognized as one of the internal factors that has an effect on knowledge management (Lu, Tsang, & Peng, 2008). Similarly, Kim and Lee (2004) stipulated that there are three components in an organizational culture that highly affect knowledge management, namely, vision and goals, trust, and social network. These three components are significant because knowledge sharing is one of the key components in knowledge management. Clear organizational visions and goals will definitely help to encourage employees to share knowledge. This is due to the involvement and participation of employees that is essential to achieve the goals and missions of a company (O'Dell & Grayson, 1998). Al-Alawi, Al-Marzooqi, and Mohammed (2007) however, stressed that interpersonal trust or trust between co-workers is crucial in organizational cultures that have strong influence over knowledge sharing. Moreover, Gruenfeld, Mannix, Williams, and Neale (1996) stated that the existence of trust among employees is necessary in order to respond openly and share their knowledge. O'Dell and Grayson (1998) also highlighted that social interaction between individuals or groups is helpful in knowledge sharing when different kinds of perspectives and knowledge will be exchanged and transferred during the interaction. Thus, organizational culture is linked to knowledge sharing and a hypothesis is formed.

Hypothesis 2 Organizational culture has a significant positive association with knowledge sharing.

Teamwork Teamwork is defined as a work or project done by associates, where each member does a part in line with the efforts from subordinates in hierarchical levels (MacNeil, 2003). According to Molina and colleagues (2007), structuring the organization into work teams is one of TQM's basic ideologies. A study of Wright, McMahan, and McWilliams (1994) explained the idiosyncratic knowledge that is relevant to another member of the team and is transferred from an individual to that particular person. When this occurs a synergy is formed and results in a rise of a new knowledge to a higher level, called group knowledge, where combinations of unique skills of each team member are consolidated towards achieving missions and goals. This is in line with the notion made by Rezgui (2007), in which teams working on projects have more opportunities to integrate distributed competences more effectively through knowledge sharing. Nevertheless, the social dilemma theory explains that knowledge sharing might arise from the public-goods dilemma (Cabrera & Cabrera, 2002). They explained that when knowledge is shared by a volunteer's contribution to a team, every member in the team will benefit from it, whether they have made a contribution or not. Hence, the company should plan a rewarding strategy where people who share their knowledge will be rewarded. Therefore, a hypothesis is developed as follows:

Hypothesis 3 Teamwork has a significant positive association with knowledge sharing.

Training and development Training and development has been recognized as vital to the implementation of TQM (Snape, Wilkinson, Marchington, & Redman, 1995) and it is the development of new knowledge and skills as a result of imparted knowledge (Goetsch & Davis, 2000). Formal training and development programs can stem from hiring trainers and facilitators to provide in-house development programs, outstation training for employees, and e-learning courses that are provided by service providers (Lamoureux, 2006). Lamoureux (2006) further identified that formal training requires the trainee to perform after-action reviews and give suggestions. Thus, they will express, share, and improve their knowledge with others during the training period. In this instance, training and development plays an important role in creating an environment which encourages every employee to share their knowledge within the organization. Goh (2002) highlighted that experimental trainings are important as these trainings could assist to solve problems such as lack of motivation, absorptive capability, and retentive capacity. Therefore, a formal and successful training will definitely encourage the employees to have the sense of knowledge sharing. Since training and development helps to improve the process of knowledge sharing, the following hypothesis is suggested.

Hypothesis 4 Training and development has a significant positive association with knowledge sharing.

Customer focus Customer focus can be defined as the degree to which a company embarks to satisfy the customers' needs and expectations in a continuous manner (Zhang, 2000). It is important that knowledge sharing shall be encouraged and promoted among all the employees, particularly for the works of those staff who very much depend on other colleagues such as the line management who rely on the sales and marketing department to provide the necessary statistical (e.g., the sales purchases figures, customers' feedback, etc.), and these are useful in accessing whether the delivery of customers' products and the comments by them are taken care of. These customers' information and feedback should be shared by the employees because it leads towards the improvement on quality. A typical example would be Philips (Royal Philips Electric), one of the well-known organizations in Holland which has a policy on putting customers as its main priority in its company culture. The practice is said to be very successful as each decision made by the company has to be focused on the customer, which include the suggestions made by the customers in activities of knowledge creations, knowledge storage that is important to customers, customers' complaints review, and applies the knowledge to accomplish the customers' needs and enhance their satisfaction (Ju, Lin, Lin, & Kuo, 2006; Wei 2009). Apart from this, every business process which emphasizes on customers' knowledge is part of the logical plus point in a company (Bassi & Van Buren, 1999). Liao (2006) explained that sharing information on customer needs among co-workers or leaders could form as a competitive advantage to the company. Buckman, in his book *Building a Knowledge-Driven Organization*, explained that the full involvement, commitment, and passion to share and use the knowledge among employees are essential to satisfy customers (Buckman, 2004). For instance, Fang, Tsai, and Chang (2005) illustrated with the example: The Intensive Care Unit is a place where fast decision making is necessary as patients' lives are in danger. In this case, the customer's need would be

the treatment while the service team (i.e., surgeons and consulting doctors) would need to share knowledge among them to make decisions to save a patient's life. At present, there is a lack of empirical research to examine the relationship between customer focus and knowledge sharing. Hence, the following hypothesis is proposed.

Hypothesis 5 Customer focus has a significant positive association with knowledge sharing.

Research framework

Based on the above literature review, a research framework was developed to examine the relationship between TQM practices and knowledge sharing. The links between TQM principles and knowledge sharing are illustrated in Figure 1. In this theoretical framework, TQM practices are independent variables and knowledge sharing is a dependent variable respectively.

Research methodology

In this section we discuss sample and data collection procedures, and operational measures of variables used in the study as well as the statistical tests used to evaluate the relationship between the multidimensionality of TQM practices and knowledge sharing.

Sample and procedures

A random sample of 450 manufacturing organizations was collected in Malaysia. The study focused on the middle management (i.e., from supervisory level and above) from ISO 9001:2000 certified manufacturing organizations in Malaysia. The certified organizations were chosen from the listing of Federation of Malaysian

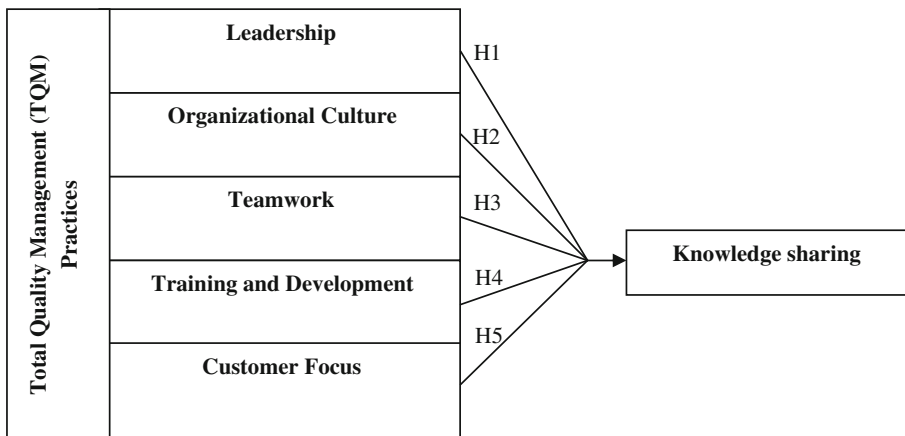


Figure 1 Research framework

Manufacturers (FMM) Directory (2007). FMM is the biggest trade organization in Malaysia, in which it represents more than 2,000 manufacturing and industrial service companies of various sizes (FMM, 2007). As a result, the sample of the present study was considered the legal representation of the population.

The analysis unit of this study was the full-time middle management employees who were knowledgeable of organizational practices on quality management and knowledge sharing in their organizations, representing different sectors of the manufacturing industry. This study did not include the part-timers and independently contracted employees. Therefore, the present sampling method would provide a more conservative test on hypotheses than a plan in which the other types of employees also took part (Tsui, Pearce, Porter, & Tripoli, 1997). According to Poh (2000), the middle management employees are those engineers, supervisors, accountants, executives, assistance managers, and departmental managers. The middle management will serve as the “traffic policemen” within an organization whereby they have to direct the information to those who are in the related divisions (Ishikawa, 1985). Many authors (e.g., Ishikawa, 1985; Manz & Sims, 1993) have chosen the middle management as the target respondents because it is recognized that these middle management are the main roadblocks to the success of TQM (Thiagarajan & Zairi, 1997).

A pretest was carried out with two operations research professors to determine the validity of the content of the survey questionnaires. Next, a pilot study was carried out in two ISO 9001:2000 certified organizations with 20 participants for evaluation. Each participant was requested to assess the survey questionnaires in terms of wordings, relevancy, and clarity. In the main survey study, a total of 450 middle management employees were randomly chosen from 25 ISO 9001:2000 certified manufacturing organizations which are listed in the FMM Directory (2007).

A cover letter was attached together with the survey questionnaire. The cover letter described the aim of the study, guaranteed anonymity of data, requested the respondent to answer each question, and seal and return the completed questionnaires using the attached envelope. An initial letter was sent and after 4 weeks, the follow up letters were then issued. Of the 450 questionnaires sent (this is highly dependent on the organization size), only 129 completed survey questionnaires were returned, contributing to a 28.7% response rate. Within the aspect of organization size, 64.85% of the respondents represented organizations with 100 employees or less, while 18.63% indicated those which have 101–200 employees, and 16.52% of those which have 201–500 employees. As a whole, more than 62.5% of the respondents were managers and the remaining were all senior managers such as the CEO managing director.

Variable measurements

Independent variables: TQM practices The measures of TQM practices were based on the five dimensions of TQM developed by Lau and Idris (2001), Prajogo and Sohal (2003), and Zhang (2000). The five dimensions, namely, organizational culture, customer focus, leadership, training and development, and teamwork, consisted of 24 items. Sample items include: “Clearly identifiable teams are utilized as the primary means to organize the work, as opposed to independent work stations or individual job functions” (*teamwork*), “This organization has provided me with training and development opportunities enabling me to extend my range of skills and

abilities” (*training and development*), “Our organization collects extensive complaint information from customers” (*customer focus*), and “Top management strongly encourages employee participation in quality management and improvement activities” (*leadership*). Responses to these items were on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Dependent variable: Knowledge sharing Similar to TQM, the measure of knowledge sharing behavior was derived and adopted from previous empirical studies (see Lin & Lee, 2004, 2005). The construct of knowledge sharing showed good validity and reliability, and it reflected overall sharing with the knowledge. Knowledge sharing behavior was measured using three items. Sample item is “My organization has processes for distributing knowledge throughout the organization.” The response option to each item was ranged from 1 = strongly disagree to 5 = strongly agree.

Statistical analysis

The research framework shown in Figure 1 was analyzed by using structural equation modeling (SEM), supported by analysis of moment structures (AMOS) 16.0 software. Several academicians as well as researchers have proposed a two-stage model-building process for conducting SEM (Hair, Anderson, Tatham, & Black, 1998; Lin & Lee, 2004, 2005), in which the confirmatory factor models were tested before testing the structural model. The confirmatory factor models identify how hypothetical constructs are measured in terms of the observed variables such as leadership, organizational culture, teamwork, training and development, and customer focus. Moreover, the structural models identify causal associations among the latent variables (Lin & Lee, 2004, 2005). To employ the two-stage model, “an adequate sample is between 100 and 200 observations; however samples with a number of observations between 50 and 400 are also acceptable” (Forza & Filippini, 1998: 10). In this regard, the sample size of the present study ($n = 129$) meets the minimum requirement, that is, 100 or more observations are desirable to examine a structural equation model.

Data analysis and results

Profiles of respondents There were 52 (40.3%) female and 77 (59.7%) male respondents. Overall, 1.55% were aged less than 25 years old, 2.33% were between 26–30 years old, 13.95% were between 31–35 years old, and the remaining 82.17% were aged over 36 years old. From these results of age group, it is known that the present data were mainly collected from middle-aged or older employees. In terms of marital status, 80.62% of the sample respondents were married. Similarly, 121 (over 93%) of the sample respondents had achieved at least a diploma-level qualification. Out of all the survey participants, 86.82% have worked more than 5 years in their current organizations. However, only 62.78% of the sample respondents have worked more than 5 years in their current position. The profiles of the survey respondents are summarized in Table 1.

Measurement model To evaluate the reliability of the collected data, the confirmatory factor analysis (CFA) was performed on both TQM and knowledge sharing constructs. In this study, the measurement model includes 29 items explaining five constructs: leadership (LD), organizational culture (OC), teamwork (TW), training and development (TD), customer focus (CF), and knowledge sharing (KS). During the initial data screening, we examined the descriptive, univariate, and multivariate statistics of the variables and discovered no apparent outlier (Jun, Cai, & Shin,

Table 1 Profiles of the survey respondents.

Profile	Number of respondents	Category	Count	Percentage (%)
Gender	129	Male	77	59.70
		Female	52	40.30
Marital status	129	Married	104	80.62
		Single	25	19.38
Age	129	Below 25 years old	2	1.55
		26–30 years old	3	2.33
		31–35 years old	18	13.95
		36–40 years old	43	33.33
		41 or above	63	48.84
Qualification	129	No qualification	8	6.20
		Diploma	25	19.38
		Bachelor degree/Professional qualification	89	68.99
		Postgraduate degree	7	5.43
Length of services	129	Less than 1 year	2	1.55
		1–2 years	6	4.65
		3–5 years	9	6.98
		6–10 years	52	40.31
		11–20 years	43	33.33
		Above 20 years	17	13.18
Job position	129	Managers	14	10.85
		Assistant Managers	15	11.63
		Executive	21	16.28
		Engineers	36	27.91
		Accountants	12	9.30
		Supervisors	24	18.60
		Others	7	5.43
No. of years in current position	129	Less than 1 year	7	5.43
		1–2 years	13	10.08
		3–5 years	28	21.71
		6–10 years	44	34.11
		11–20 years	22	17.05
		Above 20 years	15	11.62

2006). The skewness and kurtosis showed that all variables had a relatively normal distribution and appeared to satisfy the prerequisite of normality for testing a SEM since the skewness and kurtosis did not exceed the absolute value of ± 1 (Zhang, 2000).

Internal consistency reliability to examine unidimensionality was assessed by Cronbach's alpha (Lin & Lee, 2005). During this validation process, six items—the first (LD1) and second (LD2) items of (leadership) measures; the second (OC2), third (OC3), and fourth (OC4) items of (organizational culture) measures; and the third (KS3) item of (knowledge sharing) measures—were deleted due to poor factor loadings of less than 0.5 on their respective latent variables (Hoang, Igel, & Laosirihongthong, 2006). After excluding these six items, the resulting Cronbach's alpha values ranged from 0.749 to 0.804, which were above the acceptable threshold of 0.70 suggested by Nunnally (1978). Besides this, all the factor loadings were statistically significant at $p < 0.001$.

Convergent validity, defined by Lin and Lee (2005: 179) as “the degree to which multiple attempts to measure the same concept are in agreement,” was evaluated by examining the factor loading within each construct and composite reliability. According to Chau and Hu (2001: 709), the construct reliability can be computed based on the following formula: “(Square of the summation of the factor loadings) / {(Square of the summation of the factor loadings)+(Summation of error variances)}.” The explanation of the resultant coefficient is similar to that of Cronbach's alpha, except that it also takes into consideration “the actual factor loadings rather than assuming that each item is equally weighted in the composite load determination” (Chau & Hu, 2001: 709). From Table 2, the composite reliability of all latent constructs exceeded the value of 0.7. Table 2 summarized the results of convergent validity and internal reliability for the constructs.

Moreover, an examination of the correlations was used to evaluate discriminant validity. Hair and colleagues (1998) proposed that the r -value between each pair of independent variables in the correlation should not exceed 0.90. If there is a case that the correlation value exceeds 0.90, it may be suspected to exhibit multicollinearity (Hair et al., 1998). As seen in Table 3, the highest value of coefficient is 0.616 (training and development and organizational culture) which is smaller than 0.90. Therefore, it is confirmed that multicollinearity did not present among the various constructs in the measurement model (Jun et al., 2006; Lin & Lee, 2004).

The goodness of fit of the measurement model was assessed in terms of six common measures: using the ratio of chi-square statistics to the degrees of freedom, comparative fit index (CFI), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), and root mean square error of approximation (RMSEA) (Chau & Hu, 2001; Jun et al., 2006; Lin & Lee, 2004, 2005). According to Jun and colleagues (2006: 803), the ratio of Chi-square to the degrees of freedom should be less than 3 for an acceptable model fit. Browne and Cudeck, as cited by Jun and colleagues (2006: 803), suggest that an RMSEA value of less than 0.05 implies a “close-fit” and less than 0.08 indicates a “reasonable fit.” The results indicated that the measurement model fitted the data as listed in Table 4. All the model-fit (i.e., $\chi^2/\text{d.f.} = 1.026$, p -value = 0.375; RMSEA = 0.014; NFI = 0.825; GFI = 0.878; AGFI = 0.825; CFI = 0.994) indices had exceeded the respective common acceptance levels indicated

Table 2 Instrument reliability and validity.

Construct	Indicator	Standardize loading	Cronbach's α	Composite reliability
Leadership	LD3	0.707	0.828	0.798
	LD4	0.768		
	LD5	0.625		
	LD6	0.653		
	LD7	0.564		
Organizational culture	OC1	0.646	0.754	0.749
	OC5	0.812		
	OC6	0.593		
	OC7	0.557		
Teamwork	TW1	0.562	0.774	0.775
	TW2	0.734		
	TW3	0.655		
	TW4	0.566		
	TW5	0.596		
	TW6	0.504		
Training & development	TD1	0.662	0.801	0.804
	TD2	0.741		
	TD3	0.616		
	TD4	0.743		
	TD5	0.585		
Customer focus	CF1	0.689	0.779	0.784
	CF2	0.548		
	CF3	0.574		
	CF4	0.533		
	CF5	0.650		
	CF6	0.683		
Knowledge sharing	KS1	0.812	0.754	0.778
	KS2	0.830		
	KS4	0.542		

Items LD1, LD2, OC2, OC3, OC4, and KS3 were deleted due to low factor loadings < 0.5.

by previous research (Forza & Filippini, 1998; Jun et al., 2006; Lin & Lee, 2004, 2005), indicating that the measurement model appears to represent a fairly good fit with the data collected.

Structural model The overall results of structural model analysis are shown in Figure 2. The structural model analysis has a very good fit as judged from the goodness-of-fit indices ($\chi^2/\text{d.f.} = 0.983$, $p\text{-value} = 0.572$; RMSEA = 0.000; NFI = 0.8273; GFI = 0.874; AGFI = 0.819; CFI = 0.998) as listed in Table 4. All the model-fit indices had exceeded their respective common acceptance levels, suggesting that the structural model displayed to represent an acceptable model fit to the data (Chau & Hu, 2001; Forza & Filippini, 1998; Jun et al., 2006; Lin & Lee, 2004, 2005).

Table 3 Latent construct correlation^a.

Correlations ^b					
	LD	OC	CF	TD	TW
LD	1.000				
OC	.498	1.000			
CF	.497	.435	1.000		
TD	.546	.384	.468	1.000	
TW	.561	.403	.489	.461	1.000

^a $N = 129$; ^b All correlations are significant at $p < 0.01$.

Hypothesis testing The statistical significance of all the structural parameter values was examined to ascertain the validity of the hypothesized paths. The analytical results indicated that teamwork (path coefficient = 0.268, $p < 0.01$), training and development (path coefficient = 0.351, $p < 0.01$), and customer focus (path coefficient = 0.191, $p < 0.05$) were found to have a significant and positive relationship with knowledge sharing behavior. Therefore, Hypotheses 3, 4, and 5 were supported. Meanwhile leadership (path coefficient = -0.154 , $p > 0.10$), and organizational culture (path coefficient = -0.023 , $p > 0.10$) had no significant relationship with knowledge sharing. Hence, Hypotheses 1 and 2 were not supported. Table 5 summarizes the hypotheses results.

Discussion

Overall, the results of the structural analysis implied that TQM has a significantly positive relationship with knowledge sharing. The results indicated that leadership is not significant to predict knowledge sharing among middle management employees. It was determined that there is a weak relationship between leadership and knowledge sharing. Therefore, it implies that the leadership in organizations failed

Table 4 Measures of the model fit.

Model-fit index	Recommended value	Measurement model	Structural model
χ^2 — Test statistics/d. f.	≤ 3.00 ^a	1.026	0.983
Goodness-of-fit index (GFI)	≥ 0.80 ^{a,b}	0.878	0.874
Adjusted goodness-of-fit index (AGFI)	≥ 0.80 ^b	0.825	0.819
Normed fit index (NFI)	≥ 0.80 ^b	0.825	0.827
Comparative fit index (CFI)	≥ 0.90 ^a	0.994	0.998
Root mean square error of approximation (RMSEA)	≤ 0.08 ^a	0.014	0.000

^a Jun and colleagues (2006: 803); ^b Forza and Filippini (1998: 14).

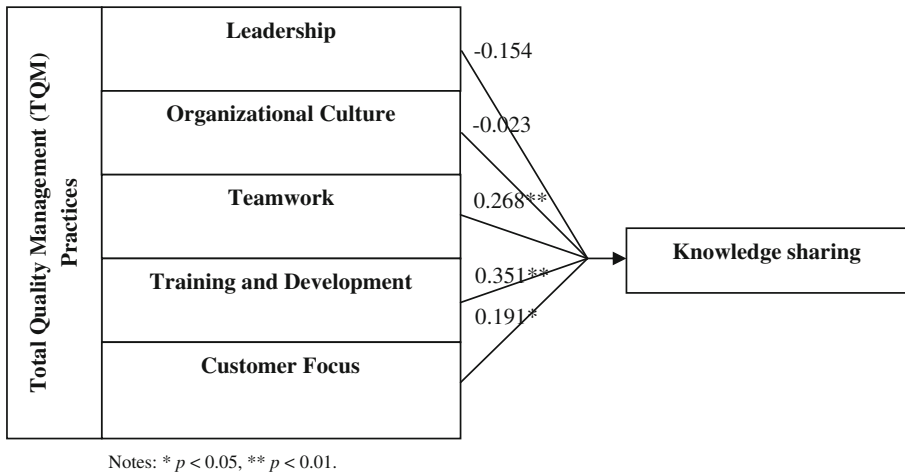


Figure 2 Results of structural model

to encourage middle management employees' to share their knowledge with each other. The result is in contrast with the findings of a study conducted by Ellinger and Bostrom (1999) as they believed that leaders play an important role to foster knowledge sharing among employees. The results implied that lack of top management commitment from organizations is one of the drawbacks in management of quality. Therefore, leaders should put more commitment in the company by mapping mutual interest on their subordinates' well being to strengthen the trust among them in order to break the communication barrier which in turn will lead to knowledge sharing (Arnold et al., 2000).

It was discovered that organizational culture is insignificant to knowledge sharing. The result of this study was found to be inconsistent with the finding of Yang (2006). The difference between organizational culture and knowledge sharing points out that the organization failed to set up a "knowledge shared" culture in the company. Some of the reasons that can be expressed to explain this situation include lack of support from top management, unclear vision and goal, low level of trust, and lack of social interaction among employees. Therefore, in order to enhance the

Table 5 Hypothesis testing results.

Hypothesis	Path	Path coefficient	Standard error	P-value	Remarks
H1	LD → KS	-0.154	0.088	0.080	Not Supported
H2	OC → KS	-0.023	0.115	0.843	Not Supported
H3	TW → KS	0.268	0.100	0.007**	Supported
H4	TD → KS	0.351	0.078	0.000**	Supported
H5	CF → KS	0.191	0.094	0.042*	Supported

* $p < 0.05$, ** $p < 0.01$; LD Leadership; OC Organizational culture; TW teamwork; TD Training & development; CF Customer focus.

organizational culture to share knowledge, top management should always emphasize sharing knowledge as well as cultivating trust among middle management employees (Mosadegh Rad, 2006), inform them with a clear vision and mission statement, and encourage social interaction frequently (O'Dell & Grayson, 1998).

The statistical result reveals that teamwork is found to be significant to enhance the levels of knowledge sharing. It is found that teamwork is perceived as an essential TQM practice and there is a significantly positive association with knowledge sharing. The finding stresses the need to work in a team and induce better TQM practices in order to ensure successful knowledge sharing. The result is consistent with the finding of Wright and colleagues (1994) where they clarified that teamwork will lead to knowledge transfer from one another and combine an individual's old knowledge to create new skills. According to a study conducted by Martin (2005), people working in teams intended to share stories and lessons learned with each other which fulfilled the result of this analysis.

Training and development was found to be positively associated with knowledge sharing. The results provide supporting evidence to the findings of Lamoureux (2006) where his studies indicated that successful training is very important to encourage knowledge sharing owing to the reason that it provides an occasion where employees are grouped together to gain and share new knowledge. Thus, the training department of organizations must provide sufficient and continuous training and development programs to ensure the success of TQM practices in contributing to the enrichment of knowledge sharing via the assistance of technological tools. This is consistent with the findings of Stoddart (2001).

The findings illustrated that customer focus is found to be significant and contributes to enhance the knowledge sharing among middle management employees. This may be due to the encouraging relationship between middle management employees and customers. Fang and colleagues (2005) posited that customer needs and expectations are required in order to assist middle management employees to share their knowledge in order to satisfy those requirements. The result of the analysis in this study confirms the above mentioned findings. This finding is also in line with the theory and assumptions of researchers such as Buckman (2004), Fang and colleagues (2005), and Liao (2006), where they all agreed that customer focus is an important element in companies that are successful in developing knowledge sharing.

Research limitations and future research

Before discussing the research implications, the limitations of our study should be noted to be considered for future research. First, although the survey results were derived from the Malaysian ISO 9001:2000 certified organizations representing Malaysia's manufacturing sector, future research may collect data from other Asia Pacific regions (i.e., Singapore, Japan, China, etc.), in order to have a more comprehensive study of the global manufacturing sector. Second, cross-sectional data were used and the time sequence of the relationships among the variables could not be determined. In this regard, longitudinal research designs would be useful in presenting evidence of causation which could not be obtained in cross-sectional

designs. Third, although questionnaire survey is a cost-effective and reliable research method, questionnaire survey may suffer response bias and lack of respondent awareness. Hence, this analysis needs to be followed by field observations and interviews of full-time middle management employees from the sample. Forth, given the lack of attention to current measurement issues in TQM and knowledge sharing research areas, the present measures are best regarded as preliminary. The five TQM practices and knowledge sharing measures are solidly based upon previous studies. Apparently, improvement in measurements of TQM key constructs is needed. Many other TQM dimensions (e.g., information analysis, process management, etc.) could potentially affect the employees' knowledge sharing.

Conclusion and implications

In conclusion, the purpose of this research paper is to investigate the relationships between TQM practices and knowledge sharing amongst middle management employees within the Malaysian ISO 9001:2000 certified manufacturing organizations. The findings provided empirical evidence that TQM are significantly and positively associated with knowledge sharing. The findings also revealed that training and development, teamwork, and customer focus showed a positive association with middle management employees' knowledge sharing. It was found that training and development was perceived as a dominant TQM practice, and had strong association with middle management employees' knowledge sharing.

Theoretical implications

This study reorients contemporary research in the TQM area and has implications in both theoretical and managerial perspectives. From the perspective of theoretical contributions, this study offers a model which integrates different dimensions of TQM and knowledge sharing behavior. The use of SEM in this study provides multiple fit indices to determine if the model was appropriately specified. Given that the model demonstrates a good fit to the data, this study has identified the relative relationship between the TQM practices and knowledge sharing behavior.

Managerial implications

This study reinforces the widely held belief that training and development, customer focus, and teamwork are positively associated with knowledge sharing. Thus, organizations should emphasize training and development, teamwork, and customer focus. Another lesson to be learned is that this research offers useful information which helps the practitioners to precisely identify areas of concern and employ remedial measures. For example, the senior management of the organizations should make efforts to identify the deficiencies in promoting knowledge sharing behavior among the middle management. Two identified aspects (i.e., leadership, and organizational culture) should be carefully revised to encourage knowledge sharing behavior among the organizational members. The top management should engage in the formulation and implementation of strategies that are consistent with the goals of

promoting knowledge sharing behavior among the middle management employees. People-oriented and flexible organizational culture should be nurtured among the middle management because these cultures are more conducive to embracing knowledge sharing behavior.

To date, many firms in the Asia Pacific region have been implementing TQM in the face of competitive national and international markets. However, research in examining the relationship between TQM and knowledge sharing has been relatively neglected in the study of the TQM domain, especially in the Asia Pacific region. In particular we know little about which dimensions of TQM are most effective in encouraging knowledge sharing behavior of the employees. Because TQM invariably include the changing of administration such as provision of training and establishment of teamwork, many of which have not been individually assessed, the findings of this study have interesting and important implications for managers in the Asia Pacific region. The findings prescribe potential implications for top management to review their TQM programs and conduct it to develop the knowledge sharing among new middle level management employees. A training and development program should be planned continuously as the results have indicated that it will encourage knowledge sharing. If top management is in the process of adapting or changing the current training and development, they need to be sensitive to impacts the new training and development will have on middle management employees' knowledge sharing behavior. It is clear that a properly designed training and development program can improve the knowledge sharing behavior among the middle management employees. Moreover, the employees' ability to acquire, integrate, and leverage knowledge is important for effective knowledge sharing. Knowledge sharing should be considered as a continuous managerial activity. Thus, organizations should manage knowledge itself and knowledge workers to sustain higher organizational capability and improve implementation of TQM. Moreover, it is imperative as a base where teamwork is necessary in most training programs. Indirectly, knowledge sharing will be easily cultivated as the analysis determines that teamwork is significant towards knowledge sharing. Furthermore, top management should always consider customers' feedback and complaints in quality improvement plans where knowledge sharing will be fostered during discussions to solve these problems.

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