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INVESTIGATING THE RELATIONSHIP BETWEEN SUPPLY CHAIN QUALITY MANAGEMENT AND KNOWLEDGE MANAGEMENT

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ABSTRACT

Supply chain quality management and knowledge management (KM) has become key strategic tool for all companies, especially in the current competitive environment. Reviewing the literature, we found many studies that analyze the crucial role played by KM initiatives as determinants of the success of Supply chain quality management. Moreover, we found also diverse studies that show high rates of failure when implementing that strategy, so there is still no integrated conceptual framework to guide companies to their successful implementation. The main contribution is that having knowledge management capabilities is not sufficient for the success of Supply chain quality management, but there are other factors to consider. In this paper, with data of 135 at the Iran khodro representative of Kermanshah province, we examine the relationships between KM and Supply chain quality management success using a structural equation model. The data showed that Quality Management (QM) practices are significantly correlated with the supplier participation strategy and this influences tangible business results, and customer satisfaction levels. The data also showed that QM practices are significantly correlated with the supplier selection strategy. The empirical results presented could be used to improve the management of supply chain networks in the economies studied.

Keywords: Knowledge management, Supply chain quality management; Organizational performance; Structural equation model

1. INTRODUCTION

Currently, knowledge society or knowledge-based economy is characterized by factors such as increased competitiveness, technological innovation and the global nature of markets (Castells, 1998). In this society, companies should pay attention preferred to knowledge when conducting its business as it becomes a key factor on which to build a competitive advantage (Beijerse, 1999; Salmador & Bueno, 2007). Moreover, in recent years, knowledge is being considered as a critical organizational resource and there is growing interest in this concept (Alavi & Leidner, 2001; Drucker, 1993). That is why KM is becoming a research priority by the academic community (Salmador & Bueno, 2007), and one of the areas that companies are allocating a greater share of spending for its implementation (Beijerse, 1999; Call, 2005). In this environment, company relations with the market are critical, and have completely changed the marketing strategies of firms to other more relational approach (Grönroos, 1994), supply chain quality management as an area of application and research. Supply chain management is a holistic and a strategic approach to demand, operations, procurement, and logistics process management (Kuei et al., 2002). Cross-country activities are normal and to be expected. These activities are often influenced by a supply chain's social and technical components. Traditionally, the focus of supply chains was on specific functionalities such as purchasing, manufacturing, and shipping to support logistics operations. The competitive environment of the 21th century requires the delivery of cost, efficiency, high service levels, rapid response, and high quality

of products and services. The effective management of technology and quality is the key to increased quality and enhanced competitive position in today's global environment. Kuei et al. (2002) suggest that supply chain quality man agreement should be distinguished from supply chain technology management. The former deals with the social components of the supply chain while the latter addresses concerns of technical systems in managing supply chains. Of interest in this study is the influence of competitive factors in supply chain quality management. Supply chain quality is a key component in achieving competitive advantage. Kuei and Madu (2001) defined supply chain Quality management (SCQM) with three simple equations where each equation represents the letters that make up SCQM. The definition is as follows:

* SC=a production–distribution network;

* Q=meeting market demands correctly, and achieving customer satisfaction rapidly and profitably; and

* M=enabling conditions and enhancing trust for Supply chain quality.

Additionally, as Zablah et al. (2004), we see KM as the main sub process of supply chain quality management because, to manage supply chain quality management effectively, companies must develop capabilities related to customer KM processes. Since these capacities are difficult to imitate, they can become a source of competitive advantage (Shi & Yip, 2007). From a resource-based perspective (Penrose, 1959; Wernerfelt, 1984), customer knowledge will be a valuable and rare asset for businesses, which will allow them to respond quickly to customer needs and adapt to changing markets (Shi & Yip, 2007). Whereas the search for competitive advantage becomes the key factor of current strategic management, we should note that to collect information about customers in the context of a relationship, and offer those customers a superior value proposition based on this knowledge, will be a key advantage, hard to imitate. At this point, it is interesting to note, that, unlike data or information, knowledge is embedded in people and not in IT (Davenport & Prusak, 1998). The way people capture, share and interpret knowledge accumulated in organizational repositories is very important in operational and strategic business activities aiming at retaining competitive advantage (Stefanou et al., 2003). In this sense, Swan, Newell, and Robertson (2000) found issues of people management, rather than IT development, pose central KM constraints. They assert there has been an over-emphasis on IT management in KM literature and that KM requires a skillful blend of people, business processes and IT. To sum up, the relationship of the discipline of supply chain quality management with technological capabilities and KM is being recognized as an important research field at present that warrants further research (Dous et al., 2005; Romano & Fjermestad, 2003). Moreover, several authors believe that while previously the majority of supply chain quality management research focused on technological aspects, the critical role of KM is beginning to be recognized in research (Lambe, 2008; Shi & Yip, 2007). Consequently, we can say that the relationship between supply chain quality management and KM is an important issue in Management research (Campbell, 2003; Shi & Yip, 2007; Stefanou et al., 2003). Such is the synergy potential of both concepts that have emerged theoretical models from the integration of both concepts: the models of customer KM (supply chain quality management models) (Gebert et al., 2003; Morgan, 2007; Tiwana, 2001).

The conceptual model—research hypotheses

KM capabilities and supply chain quality management

KM capability is the ability of an organization to capture, manage and deliver real time authenticated customer, products and services information to improve customer response and provide faster decision-making based on reliable information (Alavi & Leidner, 2001). Consequently, supply chain quality management and KM initiatives are directed towards the same goal: the delivery of continuous improvement towards customers (Dous et al., 2005). Furthermore, the creation and transmission of knowledge is seen as strategically significant as one of the fundamental processes that determine the ability of organizational learning and innovation (Salmador & Bueno, 2007). Because of this, KM will exercise a decisive role when implementing supply chain quality management, as

it involves a change in the organizational vision and therefore a great deal of learning and innovation within the organization. Additionally, previously published empirical studies on the subject highlighted KM capabilities as the variable that has a more significant impact on CRM success (Croteau & Li, 2003; Love, Edwards, Standing, & Irani, 2009; Sin et al., 2005). Consequently, we propose the following hypothesis:

H1. KM capabilities are positively linked to supply chain quality management

Organizational variables and supply chain quality management

These variables are aspects to do with human resource management, the organizational structure, and resource allocation. Considering that implementing supply chain quality management requires changes both in the way a firm is organized and in its business processes, any model needs to include a variable measuring the importance and effect of these organizational factors on supply chain quality management. In fact, in order to implement supply chain quality management, firms need to redesign their organization and orient their value chain to the demand (Kotorov, 2002). Thus, the strategy, the organizational structure and the business processes all need to be transformed to implement supply chain quality management, since success in the initiative will depend on creating the right synergy between technological systems, processes and people (Xu & Walton, 2005). On the other hand, the human factor is critically important, since even with the best defined processes and the most advanced technology the relation between people still has a determinant role in the implementation of any business strategy (Mendoza, Marius, Pérez, & Grimán, 2007). This is why factors such as employee training and motivation and the establishment of appropriate reward systems will be determinant in employees' involvement in implementing this type of strategy. Moreover, the organizational culture will play a key role also in KM: the vision of the organization, rules, structure and reward system are direct determinants of the transmission of knowledge within the company (Racherla & Hu, 2006), and therefore have a direct effect on the successful implementation of an initiative of this type.

H2. Organizational variables are positively linked to supply chain quality management.

The conceptual framework presented as in Fig. 1 is drawn from the SEM approach. In our conceptual model, each unobserved (latent) variable comprises a number of constructs

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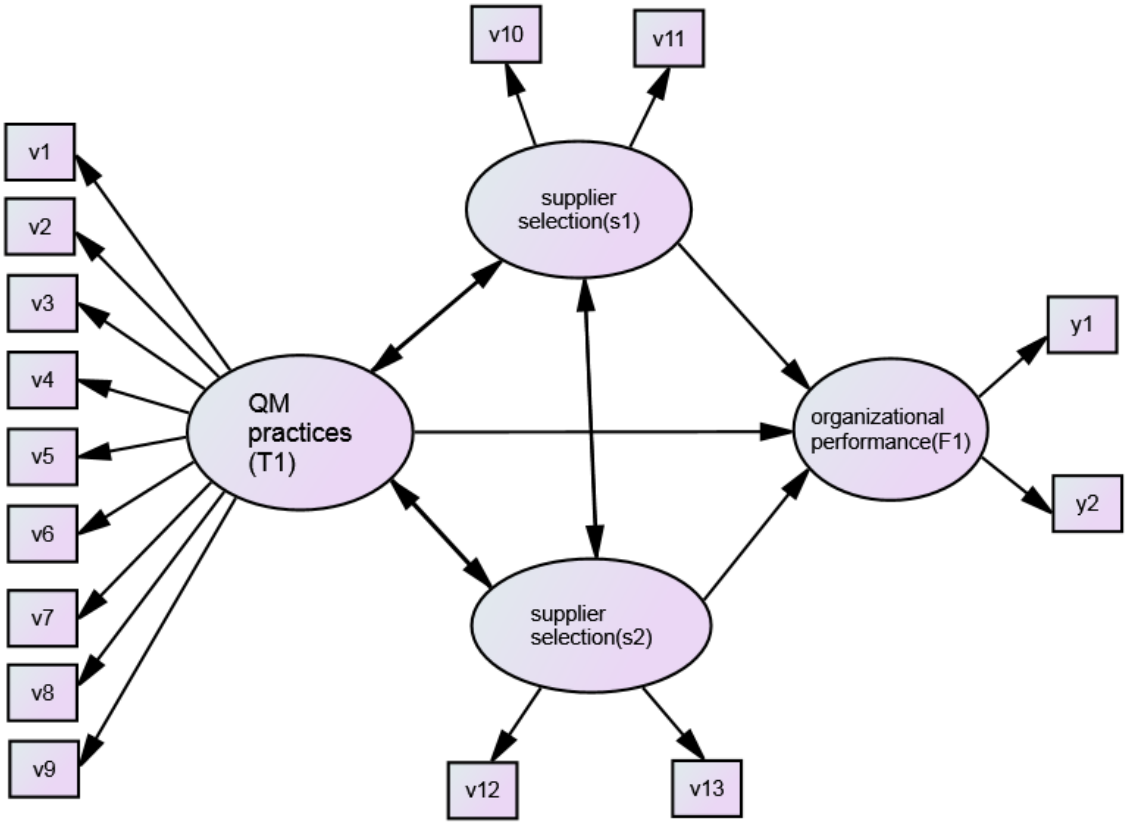


fig.1:conceptual model -structural equation modeling

For example, QM practice is represented by the following eight constructs: top management leadership, training, product/service design, supplier quality management, quality data reporting, employee relations, customer relations and benchmarking learning. Each construct include a set of measurement items (see Table 1).

Table 1

Table 1
Multivariate scales of supply chain quality management

Variables	Constructs	Description	No. of items	Code used
QM practices	Top mgt. leadership	Top management provides the necessary leadership in enabling conditions for TQ	6	V1
	Training	Job-related skills and TQC concepts are emphasized	5	V2
	Product/service design	Consider the design side of the product cycle. Emphasis is on customers' needs and wants	5	V3
	Process management	price. Use joint problem solving approach Process improvement methods are used to ensure stable and capable processes	6	V5
	Employee relations	Empower employees. and efforts of all employees	4	V7
	Customer relations	Best-in-class customer satisfaction is emphasized	4	V8
Supplier participation	Supplier participation—product design	Suppliers communicate and work with the enterprise on new product designs	1	V10
	Supplier participation—Kaizen projects/workshops	Suppliers communicate and work with the enterprise on continuous improvement projects and/or workshops	1	V11
Supplier selection	Quality-oriented supplier selection	Suppliers are selected based on their capacityto meet the needs of the enterprise	3	V12
	Cost-oriented supplier selection	Suppliers are selected based on the cost components	1	V13
Organizational performance	Satisfaction level	Component items include employee satisfaction and customer satisfaction	2	Y1
	Business results	Component items include productivity, profitability, sales growth, and market share	4	Y2

Supply participation strategy includes product design collaboration and joint kaizen projects/workshops (Wong et al., 1999; Tan, 2001; Kuei et al., 2002). Supplier selection strategy includes of quality and cost considerations (Tracyand Vonderembse, 1998; Kuei and Madu, 2001). Organizational performances are grouped into two categories: intangible and tangible business results (Kuei et al., 1997; Samson and Terziovski, 1999; Kuei and Madu, 2001). For the purpose of this study, QM practices, supplier participation, and supplier selection are considered as latent-independent variables, while organizational performance is used as latent dependent variables. From this conceptual model, a number of hypotheses can be developed. Flynn et al. (1994) suggested that supplier participation is an integral part of QM. Curkovic et al. (2000) reported that supplier participation is one of the key quality related action programs. Kuei and Madu (2001) also reported that supplier participation is an imperative part of SCQM. Thus, Saraph et al. (1989) contended that suppliers should be selected based on their practices in the area of quality. Kuei et al. (2001) reported that supplier selection is one of the critical success factors in managing supply chain quality. Therefore,

H3: QM practices and supplier selection are significantly correlated.

Tan et al. (1998) showed that supplier evaluation practices relates to the performances of firms. Kuei et al. (2001, 2002) also reported that supplier selection separates ‘‘good performing’’ firms from ‘‘not-so-good performing’’ organizations.

As a result,

H4: The level of supplier selection practice positively influences the degree of organizational performance.

Tan et al. (1998) showed a relationship between firms’ operational quality approaches and their performance. Their empirical results show that QM practices and supply chain management practices must be implemented to realize superior financial and business results. Kuei and Madu (1995) used step-wise discriminant analysis to identify QM practices that separate ‘‘good performing’’ organizations from ‘‘not-so good performing’’ units. Madu et al. (1995) found a relationship between the quality dimensions and organizational performances through the use of empirical studies. Tracey and Vonderembse (1998) postulated a similar relationship between QM practices and organizational performances. Thus,

H5: The degree of QM practice positively influences the degree of organizational performance.

Vonderembse and Tracey (1999), and Tracey and Tan (2001) argued that supplier-related practice includes of two important constructs: supplier selection criteria and supplier involvement. Together, they can improve firms’ performance level. Therefore,

H6: Supplier participation and supplier selection are significantly correlated.

A multivariate statistical technique, namely, the SEM was then used to empirically test the proposed hypotheses.

Empirical evaluation

We designed a questionnaire that was pointed at the Iran khodro representative of Kermanshah province. After the data collection, and using investigative and confirmatory factor analyses, we confirm and purified the measurement scale of the suggested model. Finally, we used the structural equation methodology to test the suggested CRM implementation prosperity model empirically. The target population for the study consists of 456 managers and supervisor located in Kermanshah province. One hundred and thirty five potential respondents were randomly selected from http:// www.tradtrade.com, which provided a comprehensive list of supply chain firms. Telephone calls were made to confirm their SCQM status. One hundred and thirty five replies were received, which constituted a response rate of 38 %. The respondents were managers and supervisors of the firms. About 80% of respondents were holding a managerial position; with 19.3% being top-level managers. Thus, the effective response rate was 17%. Participating firms were further contacted by telephone to confirm their engagements in the areas of quality

and supply chains. Kuei et al.'s (2002) instrument was used to measure constructs for all latent variables, namely, QM practices, supplier participation, supplier selection, and organizational performance. QM practices, for example, were measured by eight constructs. Each construct contains a set of indicators. Respondents were presented with 65 measurement items grouped under different construct headings (see Table 1). A 5-point interval rating scale system was used in the survey, with 5 equaling the highest extent or degree. A reliability and validity test was then applied to examine these constructs. Specifically, Cronbach's a reliability estimate test and within-scale factor analysis (Nunnally, 1967; Flynn et al. 1995; Kuei and Madu, 2001) was applied. The former was used to assess the internal consistency of the constructs, while the latter was used to measure the extent to which all indicators in a construct measure the same multivariate construct. When applying those tests, we removed the measurement item that might be noted as not being part of our predetermined constructs.

Table 2
Scaling

Variables	Constructs	a (Taiwan)	a (HK)	Loading range (Taiwan)	Loading range (HK)
QM practices	Top mgt. leadership	0.8987	0.7103	0.66–0.78	0.51–0.62
	Training	0.7848	0.7691	0.55–0.68	0.50–0.65
	product/service design	0.8748	0.8009	0.57–0.75	0.55–0.74
	Supplier quality management	0.8957	0.9000	0.56–0.80	0.61–0.84
	Process management	0.8569	0.9353	0.66–0.73	0.73–0.91
	Qualitydata reporting	0.8195	0.9313	0.52–0.77	0.79–0.90
	Employee relations	0.8241	0.9103	0.60–0.69	0.59–0.88
	Customer relations	0.8519	0.9446	0.74–0.86	0.76–0.91
	Benchmarking learning	0.9324	0.9645	0.86–0.91	0.90–0.94
Supplier participation	Product design[a]	—	—	—	—
	Kaizen workshops[a]	—	—	—	—
Supplier selection	Quality-oriented	0.8537	0.9278	0.66–0.74	0.69–0.95
	Cost-oriented[a]	—	—	—	—
Organizational performance	Satisfaction level	0.7532	0.6415	0.60	0.5022
	Business results	0.9053	0.8701	0.62–0.82	0.51–0.84

[a]One-item construct.

Table 2 presents the summary of loading ranges and a reliability estimates for each construct used in this study. It is observed from this table that almost all of our research constructs are with Cronbach's a larger than 0.8, and all of them are with Cronbach's a larger than 0.67, which reveal high reliability of our measurements. Further, all the factor loading scores are higher than 0.5, indicating acceptable validity level. In the concluding section of measurement, the mean was then taken for each multivariate construct. The test of the conceptual model was carried out using the LISREL analysis. According to Narasimhan and Jayaram (1998), LISREL is one of the most popular SEM software packages used by researchers. Following the details of the process described by Anderson and Gerbing (1988), Choi and Eboch (1998), Anderson and Narus (1990), Bentler (1992), Narasimhan and Jayaram (1998), Ahire and Dreyfus (2000), Raykov and Marcoulides (2000), Tan (2001), and Narasimhan and Kim (2001), the measurement model and structural model were checked to ensure the results were acceptable and were consistent with the underlying theory. According to Tan (2001), the formal model (i.e. the measurement model) deals with the reliability and validity of the constructs in measuring the latent variables, while the latter model (i.e. the structural model) is concerned with the direct and indirect relations among the latent variables. SEM technique is therefore

suited for our research purposes.

Table 3
Summary results of the measurement model

Variables	Constructs	Estimate (Taiwan)	Estimate (HK)	*t*-value (Taiwan)	*t*-value (HK)
QM practices	Top mgt. leadership	0.730	0.596	—	—
	Training	0.633	0.700	6.324**	5.701**
	Product/service design	0.780	0.730	7.886**	5.864**
	Supplier quality management	0.833	0.665	8.458**	5.501**
	Process management	0.660	0.661	6.615**	5.477**
	Quality data reporting	0.794	0.691	8.037**	5.646**
	Employee relations	0.695	0.671	6.979**	5.532**
	Customer relations	0.802	0.640	8.121**	5.351**
	Benchmarking learning	0.774	0.637	7.817**	5.332**
Supplier participation	Product design	0.963	0.975	—	—
	Kaizen workshops	0.918	0.975	14.86**	31.923**
Supplier selection	Quality-oriented	1.00	0.996	—	—
	Cost-oriented	0.517	−0.166	6.10**	−1.742*
Organizational performance	Satisfaction level	0.917	0.618	—	—
	Business results	0.795	0.814	6.63**	2.844**

**$p<0.05$; *$0.05<p<0.10$.

Table 4
Summary results of the structural model—Taiwan data

Description	Path	Hypothesis	Estimate	*t*-value
QM practices and supplier participation	T1–S1	H1	0.716	4.974**
Supplier participation to organizational performance	S1–F1	H2	0.459	3.179**
QM practices and supplier selection	T1–S2	H3	0.839	5.483**
Supplier selection to organizational performance	S2–F1	H4	0.156	0.865[a]
QM practices to organizational performance	T1–F1	H5	0.012	0.058[a]
Supplier participation and supplier selection	S1–S2	H6	0.682	5.553**

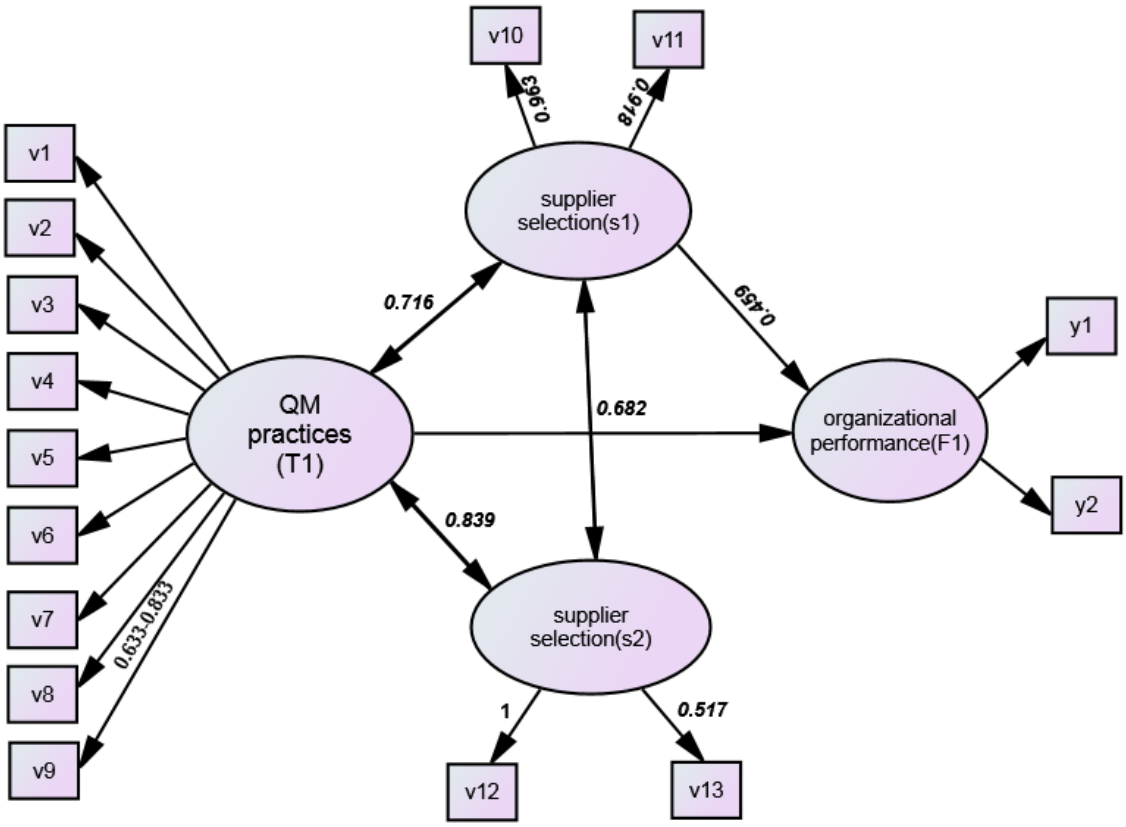
[a]$p>0.1$; **$p<0.5$.

Table 5
Summary results of the structural model—Hong Kong data

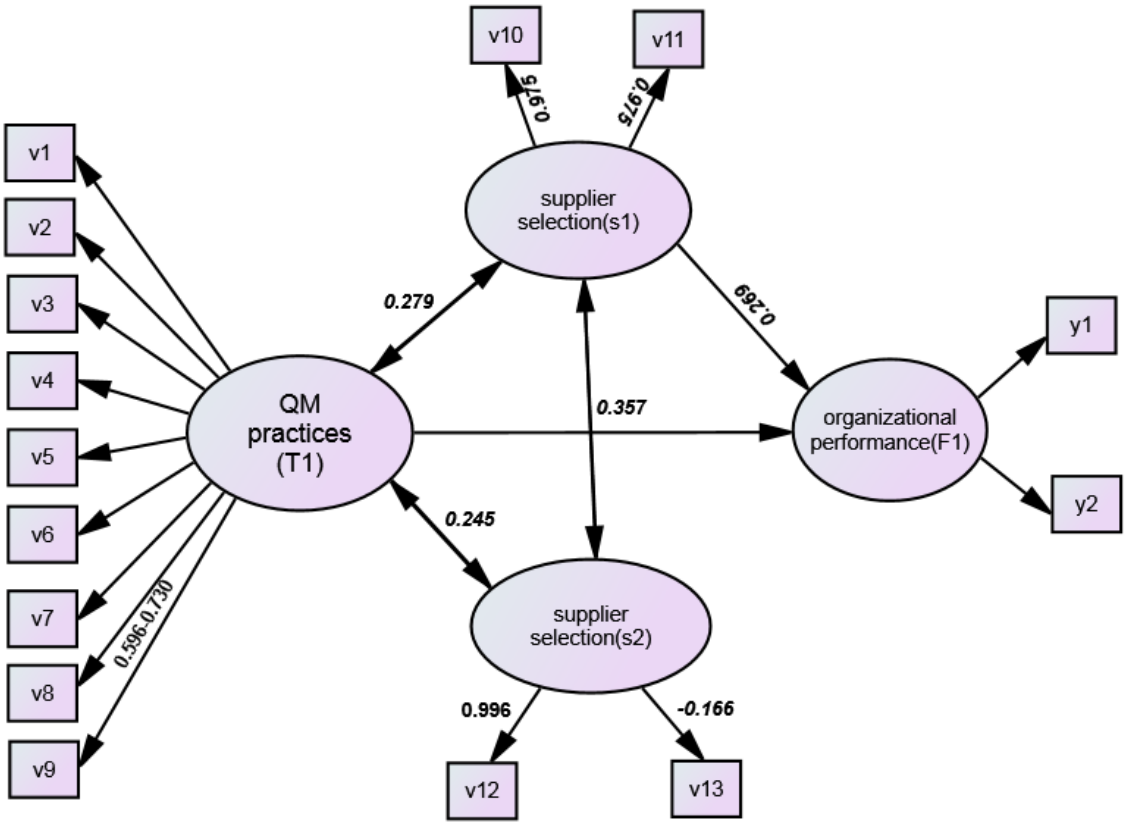
Description	Path	Hypothesis	Estimate	*t*-value
QM practices and supplier participation	T1–S1	H1	0.279	2.456**
Supplier participation to organizational performance	S1–F1	H2	0.296	2.067**
QM practices and supplier selection	T1–S2	H3	0.245	2.211**
Supplier selection to organizational performance	S2–F1	H4	0.126	1.035[a]
QM practices to organizational performance	T1–F1	H5	0.101	0.812[a]
Supplier participation and supplier selection	S1–S2	H6	0.357	3.433**

[a]$p>0.1$; **$p<0.05$.

Table 3 shows the summary results of the measurement model and Tables 4 and 5 show the results of hypothesis testing of the structural relationships among latent variables. With respect to our measurement models such as QM practices, our results showed that this variable was valid due to its indicators' parameter estimates and their statistical significant. The results further show that the overall fit measure of Kermanshah data has w2 equaling 84.89 (p40.05), and GFI equaling 0.91. According to these results, the data fits the model quite well. The end results such as parameter estimates and t-values and summary of findings are presented in Figs. 2 and 3.



x^2=86.32:all item loading and path coefficeients signification at 0.05
fig2:summary of findings taiwan data



x^2=90.96:all item loading and path coefficeients signification at 0.05
fig3:summary of findings -hong kong data

The results therefore support the structural equation model for Kermanshah data independently. Specifically, the data showed that QM practices are significantly correlated with supplier participation (H1), On the other hand, the variables KM, and supply chain quality management only have an indirect effect on supply chain quality management success, meaning that they impact supply chain quality management success influencing the organizational variables. Therefore, hypotheses 1, were only partially confirmed, since these variables only impacted supply chain quality management success in an indirect way. Similar to Zablah et al. (2004) we found that the KM process is highly dependent upon the human resources of a firm and other organizational variables which in turn influence organizational performance (H2).

There is therefore, a causal link between QM practices and organizational performance. The SEM helps to establish such a causal link. The data also showed that QM practices are significantly correlated with the supplier selection strategy (H3). Supplier participation and supplier selection are also found to be correlated (H6). Future studies should be very cautious of this relationship to avoid problems of autocorrelation. This, however, does not appear to be the case here. Further, the result does not show that supplier selection strategy influences organizational performance (H4). Our sample data from Kermanshah did not support the hypothesis that QM practices have any direct impact on organizational performance (H5). As a result, both H4 and H5 are rejected.

5. Implications and discussions for SCQM and development

There are several observations that need to be addressed in our result findings. First, the proposed hypothesis H5 is rejected, that is QM practices (T1) have no direct influence on organizational performance (F1) (Chow and Lui 2003). They revealed that only four of the proposed QM practices had a direct impact on organizational performance. Those four significant QM practices are: top management and quality policy, training, quality information reporting, and customer orientation. They recommended that the construction of measurement items for each QM practice be directly related to the subjects being studied. For instance, Ravichandran and Rai (2000) have developed a set of QM training measurement items specifically for software developments. It is recommended in this paper, that further studies should explore this suggestion. Our data, however, illustrates that the proposed QM practices (T1) have an indirect impact on organizational performance (F1). There are two paths contributing to this indirect effect. Supplier participation (S1) is serving as a mediator for the first path, whereas the other path has two mediators, supplier participation (S1) and supplier selection strategy (S2). Thus, the indirect effect of QM practices (T1) on organizational performance (F1) is 0.593 (that is 0.719_0.455+0.835_0.685_0.455) for Kermanshah data. After interviewing a few supply chain experts regarding our findings, we learned that TQM is emphasized in this region more as a management concept, rather than as a direct tool to enhance performance. Our findings also support the notion that TQM is not a quick-fix solution to problems. The long-term commitment to TQM is normally required to realize its benefits. The nature of TQM is complex, company-wide, and full implementation is not something that can be done easily or quickly (Hunt, 1992). Second, our data rejects hypothesis H4 and concludes that supplier selection strategy (S2) has no direct impact on organizational performance (F1). Chow and Lui (2003) also reported similar finding in their paper. We were informed that their selecting strategy is mainly based on the confirmation and commitment of suppliers to quality and reliability standards of their services and products. These minimal standards are firstly approved and verified by the firm's quality engineers and the quality of products/ services are checked by quality officers at a later stage. Cost is a critical element but plays little role when selecting suppliers. All selected suppliers are kept in a list called Approved Vendor/Supplier list, sorted in a rank order. The second supplier in the list will then be selected as the finalist when the first one fails to perform its services as expected. This operational procedure shows that supplier selection strategy (S2) plays an indirect role in organizational performance (F1) because the supplier performance can only be evaluated after it has been confirmed. Our data supports this claim, and also the claim that supplier participation (S1) is a mediator. Our result shows that the indirect effect of supplier selection strategy on organizational performance (F1) is 0.316 (that is 0.686_0.463) for Kermanshah data. This result is expected since most of the industries in Kermanshah is in the mature stage of their life cycle. Supplier–customer relationships are quite stable. Therefore, supplier participation (H2) is more crucial than supplier selection (H4). This may explain the insignificant result obtained for H4. The data support

the proposed direct effects of hypotheses H1, H2, H3, and H6, and indirect effects of hypotheses H4 and H5 on organizational performance. It is, however, interesting to point out that all results from the Kermanshah data are reported as moderate.

6. CONCLUSIONS

There are some important conclusions that can be drawn from this study. The results showed that key QM practices could be integrated in the supplier participation programs to provide needed collaboration, which in turn would result in improved organizational performance. This finding supports the view that SCQM programs should include traditional QM practices with special attention paid to operational items. In other words, the SCQM process incorporates not just the participation of suppliers but also, the relevant TQM practices in their environment. Organizational performance can be optimized when the organization considers its suppliers as important trading partners and members of the value chain. Quality also continues to be an important attribute in any relationship between the company and its suppliers. Results of the empirical test of the model confirm the fundamental role of the organizational factors (aspects to do with the leadership of the top management, human resource management, functional integration, and organizational structure) in the implementation of supply chain quality management. Although the literature has emphasized the role of KM as the key determinant of supply chain quality management success, according to our analysis, the organizational variables are the real antecedent of it, since they mediate the effect of the rest of the variables (including KM capabilities, technological and customer orientation factors) on supply chain quality management success. These findings show that even if the firm carries out KM initiatives, acquires the most advanced technology and tries to generate a customer-centric orientation, if these initiatives are not integrated into the organization, the firm does not redesign its organizational structure or processes, organization members do not all participate in the project, and change is not lead appropriately, the implementation of supply chain quality management will not be successful. In summary, these results are noteworthy in that similar outcomes were obtained with two independent data sets collected from two different regions. The outcomes could provide a valuable guide in the practice of global SCQM. Our intent is to see how global supply chain factors react to different environmental settings. It appears, based on this study, that the demand for SCQM is the same irrespective of the environment. However, more research is needed before this conclusion can be generalized to other countries or regions.

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