2011 International Conference on Financial Management and Economics
IPEDR vol.11 (2011) © (2011) IACSIT Press, Singapore

Integrating Total Quality Management and Knowledge Management to Supply Chain Learning: A Structural Approach

Siew-Phaik Loke [1], Alan G. Downe [2] Murali Sambasivan[3] , Khalizani Kalid[1] and Keng-Boon Ooi[4]

[1] Universiti Teknologi MARA (UiTM) Perak, Malaysia [2] Universiti Teknologi Petronas, Malaysia
[3] Universiti Putra Malaysia 4 Universiti Tunku Abdul Rahman, Malaysia

Abstract. The purpose of this paper is to demonstrate how total quality management (TQM) and knowledge management (KM) can be integrated into a unified framework to promote supply chain learning among partnering firms. Mail questionnaire were sent to the managers of the Malaysian manufacturing and service firms. A total of 202 companies participated in this study. While greater level of TQM practices enhances the KM practices, the results revealed that both TQM and KM are significantly positively related to supply chain learning. The findings of this study empirically tested and confirmed our integrated model. We hope that the results provide greater understanding in the areas of quality and knowledge management, and how these practices can enrich the supply chain learning among partnering firms.

Keywords: TQM, knowledge management, supply chain, Malaysia, structural equation modelling

1. Introduction

The origin of the supply chain management (SCM) is perceived to derive from logistics management [1, 2, 3] and it has been referred as "integrated logistics management" [4]. Over the times, SCM has evolved from functional focus to cross-functional collaborations. This collaborative strategy has gained its popularity among supply chain firms in an effort to capture cost savings, to fulfill customer satisfaction, to facilitate synergies creation, to add values to all supply chain partners and ultimately to remain competitive in the industry. Overall, SCM is seen to include sourcing of raw materials; productions; product development and commercialization; marketing; product returns and recycling; managing supplier and customer relations [5,6, 7].

In the SCM literature, many studies emphasized the linkages between adoption of total quality management (TQM) practices and organizational outcomes including learning and knowledge transfer. In a recent study by Vanichchinchai and Igel [8] noted that:

> *"Both TQM and SCM offer unique frameworks to integrate participation and partnership, since they require participation from all internal functions and continuous collaboration with all external partners… However, TQM focuses more on internal participation whereas SCM places more emphasis on external partnership (p.254)"*

Talib et al. [6] argued that TQM and SCM are identified to be the most important strategies for manufacturing and services firms as well as small-to-medium sized enterprises (SMEs). Applications of TQM are useful in reducing process variances which is directly linked to certain supply chain performance measures e.g. cycle time and delivery dependability. SCM practices embrace quality management initiative in order to achieve better product quality and development [9]. For example, Dick [10] reported that firms with a strong TQM environment have better business performance improvement than firms who only possessed QCert (e.g. ISO 9000 certification). We know that, to certain extent, SCM relies on TQM to effectively integrating suppliers, manufacturers, distributors and customers.

TQM, learning and knowledge management (KM) are closely related as they are based on one common notion – organizational development [11]. Learning involves accumulating of knowledge and it helps firms to create new knowledge-related capabilities. These capabilities are knowledge intensive, tacit and dynamics in nature [12]. Although knowledge is a powerful tool for firms' competitiveness, building a learning organization is neither an easy task [13]. Firms are encouraged to learn and acquire skills, products, technology and knowledge that are unique to the relationship through value creating activities [14]. At the same times, the partnering firms are challenged to keep their proprietary information and core competencies.

The aims of this study are twofold: First, we sought to develop an integrated TQM and KM model on supply chain learning (SCL). Secondly, using structural equation modelling (SEM), we empirically tested the integrated model using data drawing from both manufacturing and services firms. The following section describes how we constructed the model and formulated the hypothesis. Finally, we present the data analysis, research findings and discussion.

2. Model Development and Hypotheses Formulation

The integrated model was used to test the relationships among TQM, KM and SCL (See Fig. 1). The causal relationships, depicted by arrows, were investigated by LInear Structural RElations software (LISREL) through SEM. The theoretical bases of the relationships among the constructs are discussed hereafter.

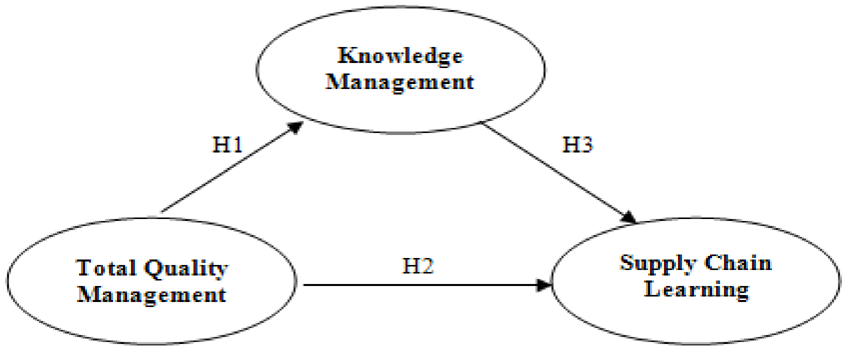

Fig. 1: Research Model

2.1. Relationships between total quality management, knowledge management and supply chain learning

TQM embodies the similar basic principles of quality assurance, total quality control and firm-wide quality control. Through continuous improvement, TQM practices help firms to achieve conformance to product specification and reduce variability. Many researchers had acknowledged the importance of quality in long-term sustainability and future competitiveness [7, 15].

Both TQM and KM aim to improving the work-processes of firm to better serve the customers. While TQM focuses on quality improvement in all functional areas and at all levels in a firm, KM practices are key to continuous performance improvement which embed learning processes (before, during and after execution of plans) into the way teams plan, execute and assess performance [16]. Zetie [11, p.318] added that TQM and KM is closely related through:

- Deming's emphasis throughout a lot of his later writings on the concept of "profound knowledge" as a cornerstone of quality;
- the realization that an organization's quality manual is the depository of its process knowledge.

The Deming Wheel, or plan-do-check-act (PDCA) cycle demonstrates the dependency on documented testing results for continuous improvement and re-engineering programs. Ju et al. [17] claimed that integrating these two concepts are useful to firms because it increases the implementation options particularly for those seeking for organizational changes. From the theoretical perspective, it is important to recognize the relationship between TQM and KM as it helps expand a broader use of explanatory models developed in a specific context [11]. Therefore:

H1: TQM practices will have significant impact on knowledge management practices

Vanichchinchai and Igel [8] noted that customers today demand for better product quality, faster delivery and cheaper cost; and only by meeting these requirements the firms will be able to achieve customer satisfaction and retention. In an effective integrated supply chain environment, partnering firms are able achieve costs reduction, processes improvement and product development through enhanced innovation capabilities [14]. Development of capabilities and skills are thus required to compete in the fast changing business world.

Prior researchers such as [18, 19] recognized the importance and the potentiality of quality assurance models to support supply chain integration and integrity of product specification. The impacts of TQM practices on organizational learning can be further expanded to supply chain learning. This is because in a number of industries, it is common to find supply chain networks that are built to enable joint product development, transfer of knowledge and/or technology. Quality improvement are thus become the driving forces to reduce amount of rework or inefficiency. Learning, re-learning and un-learning activities enables partnering firms to monitor performance and propose improvement for mutual benefits. Therefore:

H2: TQM practices will have significant impact on supply chain learning

2.2. Relationship between knowledge management and supply chain learning

The benefits of collaborations have driven the proliferation of supply chain partnerships. While witnessing the increased of the numbers of collaborative ventures such as strategic alliances, joint venture, marketing agreement and research consortium, Nielsen [12] highlighted that there has been a paradigm shift in firms from focusing on management of physical goods to intangible assets such as knowledge. Spekman et al. [14] urged the firms to focus on the key strategic issue which is the ability to leverage a partner's capabilities beyond tangible assets and explicit knowledge. This is because some skills and assets which are tacit and not easily codified but equally important and can give the firm a relative advantage [20]. Since the tacit knowledge is hard to codify and transfer, it makes sense to collaborate closely in supporting the development of new knowledge-related capabilities [12].

Loke et al. [21] associated learning to KM since learning serves to be the main building block for knowledge transfer. KM plays an important role to supply chain partnering firm because they make joint decision, solve problems while coordinating their day-to-day operations. These activities contribute to the regular changes of their knowledge bases. Collectively, these changes can help them to increase cooperation and improve flexibility, to reduce costs and to satisfy the customers' needs. Spekman et al. [14] argued that the principles of knowledge as a competitive source can be so powerful that these benefits could be extended from individual partnering firm to the entire supply chain.

H3: Knowledge management will have significant Impact on supply chain learning

3. Data Analysis and Results

3.1. Profiles of Respondent Firms

Mail surveys were sent to managers of manufacturing and service firms (e.g. plant manager, operation and general manger). These firms were randomly selected from the Federation of Malaysian Manufacturers (FMM) directory. A total of 202 Malaysian manufacturing and service firms participated in the study: manufacturers (n=99); services firms (n=93) and others (n=10). Out of these 99 manufacturing firms, majority of them are final product manufacturers (33.3%), follow by raw material manufacturer (28.3%) and component manufacturer (27.3%). With regard to the quality assurance program, only 46 respondent firms (22.8%) are ISO-certified.

3.2. Data Analysis

The data collected were entered and processed using Statistical Package for the Social Science (SPSS for Windows) to calculate the reliability coefficients of the instruments. Confirmatory Factor Analyses (CFA) were performed on the TQM, KM and SCL to determine validity using LISREL. Structural equation models and path analyses were estimated using the same version of LISREL. In this study, Cronbach's coefficient alpha was used to measure the reliability of the measure was at the acceptable range (See Table 1).

Table 1: Results of Reliability and Validity Test (n=202)

Variables and Items	Total Iterm	Reliability Test	Validity Test	
		Chrobach Alpha	GFI	RMSEA
Total Quality Management				
• Leadership	5	0.908	0.98	0.078
• Strategic Planning	5	0.852	0.99	0.041
• Customer Focus	5	0.892	0.98	0.080
• Process Management	5	0.881	0.98	0.052
• Information Analysis	5	0.920	0.99	0.045
• Human Resource Focus	5	0.885	0.98	0.067
Knowledge Management				
• Knowledge Management Process	5	0.890	0.98	0.051
• Leadership in Knowledge Management	4	0.904	1.00	0.000
• Knowledge Management Culture	5	0.907	0.98	0.043
• Knowledge Management Technology	5	0.918	0.99	0.022
• Knowledge Management Measurement	4	0.901	0.98	0.068
Supply Chain Learning				
• Absoprtive Capacity	4	0.889	0.99	0.047
• Pre-Conditions for Learning				
o Shared Culture	4	0.913	0.99	0.055
o Commitment	3	0.907	1.00	0.000
o Trust	3	0.844	1.00	0.000
o Communication	4	0.910	0.99	0.021
o Integrative Mechnism	5	0.938	0.99	0.006
• Learning Enablers	6	0.933	0.98	0.014
• Learning Structure/system/process	5	0.917	0.99	0.034
• Joint Efforts				
o Joint Decision-Making	4	0.907	0.98	0.047
o Win-win Approach	4	0.884	0.98	0.056

The measurement adequacy of this study was verified by confirmatory factor analysis (CFA) using LISREL. Goodness-of-fit index (GFI) and root mean square error of approximation (RMSEA) were used to determine the construct validity. While closer GFI to 1.00 indicates better fit, lower value of RMSEA is required to demonstrate goodness-of-fit of the measurement model. RMSEA values ranging from 0.05 to 0.08 are deemed acceptable. Satisfactory fits were achieved for all these constructs (see Table 1).

3.3. Structural Model

Using SEM, path coefficients were calculated to demonstrate the relationship between TQM, KM and SCL. In this study, we used multiple fit indices: (1) Chi-Square (χ^2) statistics to the degree of freedom (*df*); (2) the absolute fit index (GFI and RMSEA); (3) the comparative fit index (CFI) and (4) the Normed-fit index (NFI) to evaluate the goodness of fit of the measurement model. Hair et al. [22] argued that GFI, CFI and NFI values that above 0.90 are indication of a satisfactory model of fit. As shown in Fig, 2, the result showed that the structural model analysis deem to have a reasonable good fit for the data collected [χ^2 = 122.54, *df* =101, GFI = 0.87, CFI = 1.00, NFI =0.98, RMSEA = 0.046] with slight lower values of GFI. The ratios of chi-square to degree of freedom were 1.21 which is less than 3.0 indicating a good fit [17].

3.4. Hypothesis Testing

Hypothesis 1, 2, 3 were found to be significant (see Fig. 2). This shows that the TQM has significant positive relationships to knowledge management (H1) with path coefficient of 0.92; $p<0.01$, and to supply chain learning (H2) with path coefficient of 0.28; $p<0.05$. It means high level of TQM practice lead to greater level of knowledge management (KM) practice and greater learning among supply chain partners. The results also demonstrated the positive significant relationship between KM practice, and supply chain learning (H3) with coefficient of 0.76; $p<0.01$.

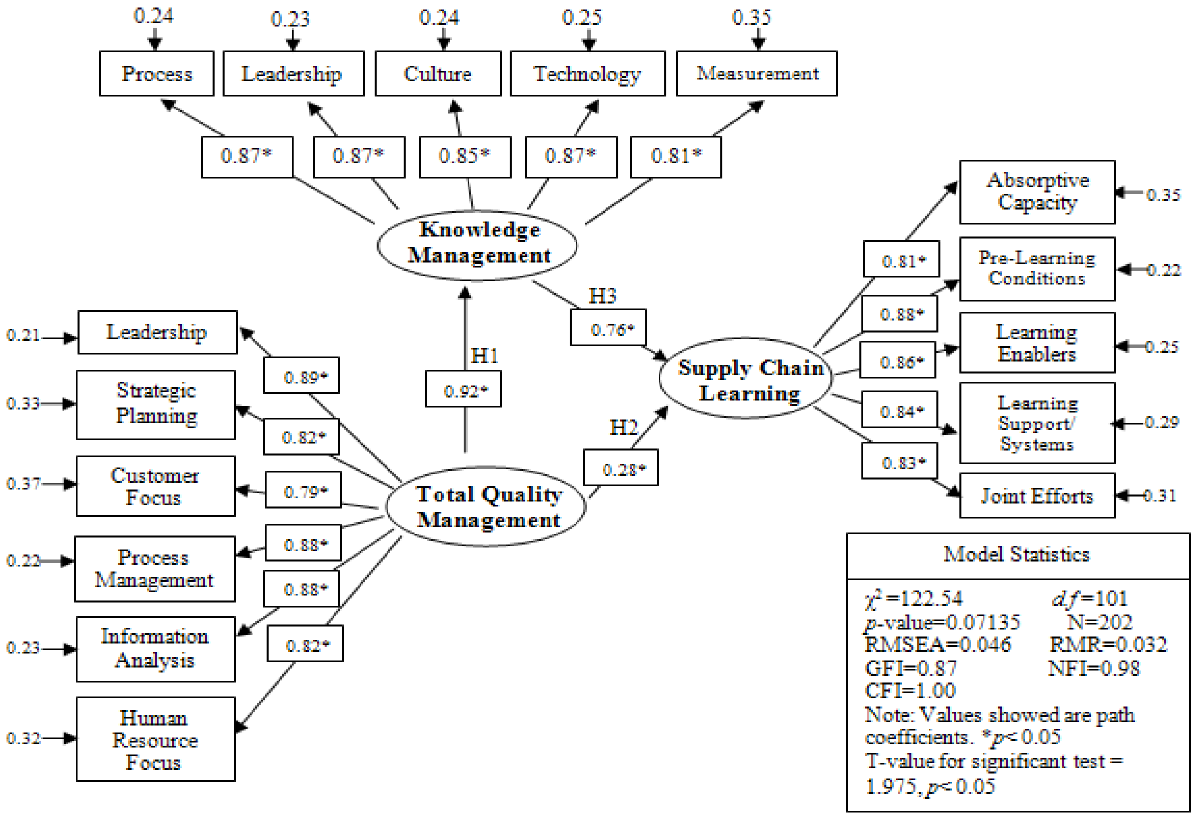

Fig. 2: Path Analysis Results

4. Discussion and Conclusion

Learning within supply chain provides important supports for inter-firm collaboration particularly when partners can learn from the past mistakes [14]. This study integrates two important strategies, namely TQM and KM to examine their impacts on the supply chain learning. The five dimension of TQM used are: leadership, strategic planning, customer focus, process management, information analysis and human resource focus whereas knowledge management practices are anchored into five areas: KM process, KM leadership, KM culture, technology and KM measurement. We adopted the similar approach as in the study conducted by Spekman et al. [14] in measuring supply chain learning. Our study has proposed and tested an integrated model for TQM and KM to supply chain. The results of this study showed that the KM level within a firm can be greatly enhanced by the TQM practices. Firms' implemented quality planning, control and assurance requires reviews and continuous inputs to enable and sustain excellence in performance.

In addition, we found that firms that are committed to the quality management have greater learning experiences because (1) they are more inclined to invest in technology and information systems that support the learning activities, and (2) these partnering firms are more willing to share as they believe creating new knowledge capabilities can increase their competitiveness.

Armistead [23] suggested that application of KM in operational context is useful since information collected can be used strategically in future plans such as new designs of product and services. Consistent with previous findings (e.g. Sambasivan et al [24]), our results revealed that KM practices allow greater understanding on the supply chains members, both upstream and downstream, and building stronger relationships that facilitate realizing the synergies of inter-firm collaborations.

5. Acknowledgements

This work has been supported by the Fundamental Research Grant Scheme of the Ministry of Higher Education Malaysia (Project No: 600-RMI/SPP/FRGS 5/3/Fsp (48/2010).

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