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Int. J Sup. Chain. Mgt   Vol. 5, No. 4, December 2016

Exploring the Moderating Effect of Quality Management Practices towards Supply Chain Performance in Malaysia Automotive Industry

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Abstract— **This article reports a study designed to explore the state of supply chain management in the Malaysian automotive industry by examining the moderating effect of quality management practices towards the relationship between supply chain strategy and supply chain performance. This study is accomplished by using survey questionnaire that was answered by 65 respondents from Malaysian automotive components manufacturing firms. This study used the SPSS tool to test the hypotheses. The study found that quality management practices act as a quasi-moderator towards relationship between supply chain strategy and supply chain performance. This study also empirically proved that for highly quality management practices, it can be as a strategy for improvement of supply chain performance. Implications of the finding are further elaborated.**

Keywords— *supply chain strategy, quality management practices, supply chain performance*

1. Introduction

The level of competition in the business world today has changed from the national to the global level. The same scenario can be seen in the automotive industry in Malaysia where the major manufacturers and automotive component manufacturers need to become more competitive to absorb pressure from multinational companies are significantly increasing. As recommended by the Malaysian Automotive Institute (MAI), the automotive industry had to respond to a number of major developments, including the development of automotive technology, liberalization, and trends of restructuring and rationalization among international automotive

companies. These developments have a clear impact on the policies and strategies on domestic and regional markets. Thus, supplier companies and automotive companies themselves must understand these developments and take appropriate measures in terms of technology, product quality improvements and cost savings. One of the alternatives to deal with this issue is by improving the supply chain performance. Guangshu [1] states the quality management can help in improving the operational efficiency and competitive capacity in the supply chain system as a whole. Therefore, this study is designed to examine the moderation effect of quality management practice towards relationship between supply chain strategy and supply chain performance in the automotive industry in Malaysia.

2. Literature Review

Council of Supply Chain Management Professionals (2004), previously known as the Council of Logistics Management (CLM) is a professional body that promotes the practice, development and education of supply chain practices, defines supply chain management as "SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities, including coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers". Meanwhile, Cooper et al. [2] defines supply chain management as the management and integration of the entire set of business processes which provide products, services and information that can add value to our customers. This aspect becomes particularly relevant to the automotive industry and supply chain management is said to be the basis for good performance and competition in the automotive industry.

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Supply chain strategy refers to the nature of procurement of raw materials, transportation of materials to and from the company, product or manufacture of the operation to provide the service, and distribution of the product to the customer, along with any follow-up service and a specification of whether these processes will be performed in-house or outsourced. Naylor *et al.* [3] and Towill and Christopher [4] suggest three types of supply chain strategy which are agile supply chain, lean supply chain and hybrid supply chain. Their case studies show how the lean and agile supply chains have successfully merged to form a strategy referred to as a hybrid supply chain. However, Naylor *et al.* [3] use the term of leagile that refers to the integration between these lean and agile supply chain.

Contribution of quality management in improving supply chain management is undeniable. Many organizations realize the importance of quality management applications in supply chain, but a study by Hussain [5] showed that many projects done isolative without integrating the quality management with supply chain. However, most of previous studies focused on the relationship between implementation of total quality management with performance [6]-[7] but not in the context of the supply chain. This study believes that the quality management practices can enhance cooperation and create linkages between entities in the supply chain and must be dynamic and responsive in the long run. As stated in several previous studies such as Guangshu Chang [1], Gunasekaran [8] and Vanichchinchai [9]. According to Guangshu Chang [1], application of quality management will help in improving operational efficiency and competitive capacity in the supply chain system as a whole. However, still a need to explore the relationship and influence of quality management practices in improving supply chain performance.

Most organizations less focused on developing an effective performance measurement and performance metrics for supply chain management [10]. According to Holmberg and Robert [11] states a of problems in measuring the performance of supply chain management is the lack of relationship between strategy and performance measurement, too dependent on the financial figures as key performance indicators, too much isolation and measurements that are not compatible and finally, using the single-firm management style when measuring supply chain. Therefore, measurement of supply chain performance in this study was based on the organization's strategic goals of the lean, agile or hybrid supply chain. The focus of lean is the elimination of waste and non-value activities, while the focus of agile is meeting customer needs quickly, efficiently [10] and the uniqueness of the product [12]. Thus, the dimensions of

supply chain performance measurement are cost-effective, lead time, innovation, time to market and flexibility to customers.

3.   Research Methodology

A set of questionnaire was developed to collect data for this study. In order to achieve the objectives of the study, the Malaysian automotive suppliers firms were selected as the population. The database was obtained from lists of suppliers given by automotive makers in Malaysia such as Proton, Perodua, Honda, Isuzu and Suzuki. This list of the suppliers consists of electrical, electronic, metal, plastic, rubber and other automotive components. The supplier firms involved in this study were ranged from medium to big companies, with more than 50 employees. The personnel involved in the survey were those from managing directors, senior managers and senior executives. The questionnaire was consisting of four parts; (a) the general information of the organisation (ownership, number of employees, types of product produced and quality system certification), (b) supply chain strategy, (c) supply chain practices and (d) supply chain performance. A questionnaire using a six-point Likert scale was used to gather data for each construct of research model.

The prime consideration of the design in this survey instrument was to keep it short and focused in order to obtain an adequate response rate. Questionnaires were designed based on a multiple item adapted from previous study [4], [13]. The process of developing the questionnaire also included a q-sort procedure. This q-sort procedure was used to improve the items construct placement and also rephrase statement based on the actual respondents. Experts from industries and academics were also consulted. The comments and feedback were analysed and a few modifications were made.

Table 1. Reliability Test Results – all variables

Variables	No of Items	Cronbach's Alpha
Supply Chain Strategy	18	0.938
Quality Management Practices	46	0.982
Supply Chain Performance	20	0.955

In the case of reliability test, Cronbach's alpha was employed to measure the internal consistency of the research instrument. According to Sekaran [14] reliability measurement is an indication of the stability and consistency of the instrument. The summaries of the

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reliability analysis are given in the Table 1. As can be seen from Table 1, all alpha values are above 0.6 as suggested by Nunally and Bernstein [15]. As such we can conclude that the measurements are reliable.

4.   Findings and Discussions

The total numbers of 275 questionnaires were posted in two waves during the months of December 2011 to January 2012 and from February 2012 to March 2012. A total of 67 questionnaires were received. In the first period, the number of questionnaires received back was very low at the response rate of 11.6% only. Increase the number of questionnaires posted in the second period, a total of 45 questionnaires received. Response rate increased to 24.36%. This makes all their forms can be collected 67 questionnaires. However, 2 questionnaires were rejected due to not valid for analysis. So, the final questionnaire can be used for further analysis is 65. This response rate is low but can be adopted based on previous studies in the manufacturing industry especially in Malaysia automotive industry, the acceptable range of response rate is 18-26% [16]. Furthermore, non-response bias test was conducted where the results shows in the table 2. These test results confirm that the data were free from non-response bias. In other words, this study not only shows the results of the study sample, but can be used to generalize the entire population of automotive industry in Malaysia.

Table 2. Result of Non-Response Bias Test

Variables	Wave 1 Mean (N=21)	Wave 2 Mean (N=44)	Levene's test	t value
Supply Chain Strategy	4.72	4.93	F = 0.003 p = 0.954	t = 1.108 p = 0.272
Quality Management Practices	4.68	4.83	F = 1.427 p = 0.237	t = 0.794 p = 0.430
Supply Chain Performance	4.49	4.52	F = 2.247 p = 0.139	t = 0.152 p =0.880

4.2   Respondents Profile

The first aspects to be investigated were the respondents and organizational profile involved in this study. Table 3 shows the respondents profile such as the job position and working experiences in the automotive industry. It was found that the respondents were mainly holding the post manager or higher. Most of them (49.2%) have been

involved more than 10 years in the automotive industry. This figure shows they have sufficient knowledge and experience to response the supply chain issues in their company.

Table 3. Respondent Profile

1	Position	Frequency (%)
	Executive	11 (16.9)
	Senior Executive	10 (15.4)
	Engineer	1 (1.5)
	Assistant Manager	4 (6.2)
	Manager	25 (38.5)
	Senior Manager	2 (3.1)
	Senior Expert	1 (1.5)
	Coordinator	1 (1.5)
	General Manager	2 (3.1)
	Managing Director	2 (3.1)
	Director	4 (6.2)
2	**Years of Experiences**	**Frequency (%)**
	Less than 5 years	11 (16.9)
	Between 5 to 10 years	22 (33.8)
	More than 10 years	32 (49.2)

Table 4. Organization Profile

1	Organization Ownership	Frequency (%)
	100% Foreign	10 (15.4)
	100% Local	41 (63.1)
	Joint Venture	13 (20.0)
2	**Organization Size**	**Frequency (%)**
	Less than 50 employees	10 (15.4)
	Between 51 - 150 employees	15 (23.1)
	More than 151 employees	40 (61.5)
3	**Types of Products Produced**	**Frequency (%)**
	Assembly	32 (49.2)
	Metal Component	13 (20.0)
	Electronic Component	4 (6.2)
	Plastic Component	16 (24.6)
	Electrical Component	15 (23.1)
	Rubber Component	13 (20.0)

Table 4 shows the profile of organizations involved in the study. It was found that most of the organizations involved in this study is local ownership of 63.1%. Organization with the status of the joint venture is 20% and the rest is completely foreign ownership. Size of the organization referred to the number of employees in the organization. According to Ying [17], organizations need to have more than 100 employees to effectively involve in the supply chain activities. It was found that 61.5% of the organizations have more than 150 employees and only 15.4% of the organizations that have less than 50

employees. In terms of products produced, most organizations involved in the assembly of products 49.2%. In addition, the percentage of organizations that produce of plastic components, rubber products, electrical / electronic and metal are respectively 24.6%, 20%, 29.3% and 20%.

4.3 Moderating Effect of Quality Management Practice towards relationship between Supply Chain Strategy and Supply Chain Performance

This test describes the effect of moderation variables on the relationship between independent variables and dependent variable. Moderating variables in this study is the practice of quality management, while the independent variables studied were the supply chain strategy. Dependent variable of this study is the performance of the supply chain. This test is performed by using the Enter method of hierarchical regression analysis and according to the rules proposed by Baron and Kenny [18]. To test the moderating effect, a three-step hierarchical was conducted to determine what proportion of the variance in a variable is explained by other variables when these variables are entered the regression analysis in a certain order [19]. In the first step, the direct effect of independent variables was gauged. Second step, the moderating variable was entered to gauge whether the moderator had a significant impact on the dependent variable. In the third step, the interaction terms were entered to see any additional variance explained. Importantly, once step three show a significant R^2 increase with a significance F Change value, it can be concluded that there is moderating effect existed.

The results of hierarchical regression analysis were as follows:

1. In step 1, supply chain strategy variable was entered in the equation. As the result, value of R^2 is 0.461 which explaining 46.1% variation occurs on the performance of the supply chain.

2. The variable of quality management practices was entered in the step 2, the total variation of supply chain performance was increased to 63.7%. Beta value = .647, p<0.01 indicates quality management practices have a significant influence on the supply chain performance. This proves that quality management practices are a predictor that can improve supply chain performance.

3. For the step 3, the interaction term between supply chain strategy and quality management practices (SCS*QMP) was entered into equation. $R^2 = 0.665$ shows that this interaction can

explain the variation of supply chain performance by 66.5%. The value of B = .215**, p = .026 shows that the existence of interaction effects of quality management practices towards relationship between supply chain strategy and supply chain performance.

Table 5. Result of the moderation effect test

	Std Beta Model 1	Std Beta Model 2	Std Beta Model 3
Independent Variable			
Supply Chain Strategy	.644	.103	-.889
Moderating Variable			
Quality Management Practices	-	.647	-.349
Interaction Terms			
Supply Chain Strategy x Quality Management Practices	-	-	.215**
R^2	.461	.637	.665
Adjusted R^2	.453	.625	.649
R^2 Change	.461	.175	.028
Sig. F Change	.000	.000	.026

Moderation effect size calculation is as follows:

$$f^2 = \frac{R_i^2 - R_m^2}{1 - R_i^2} = \frac{0.461 - 0.665}{1 - 0.461} = -0.378 \quad (1)$$

The results show that the size of the moderation effect is moderate ($f^2 = -0.378$; Cohen 1988). Therefore, the beta value is found to change significantly (B= .215, t= 2.277). Thus, this study confirms that quality management practices to act as a moderating variable on the relationship between supply chain strategy and supply chain performance.

Overall, the results of analysis provide a significant value of interactions between supply chain strategy with quality management practices (model 3) and to influence of quality management practices on supply chain performance (model 2), this shows that the quality management practices have act as quasi moderator towards the relationship between supply chain strategy and supply chain performance.

A graph also plotted on the relationship between supply chain strategy and the level of supply chain performance with quality management practices as the moderator. Figure 1 shows that a high level of quality management practices would benefits on supply chain performance. The slope of the straight line for high level of quality management practices was lower than the slope of the straight line for low level of quality management

practices. This indicates at low level of quality management practices, the relationship of supply chain strategy with supply chain performance is strong or important compare to a high level of quality management practices.
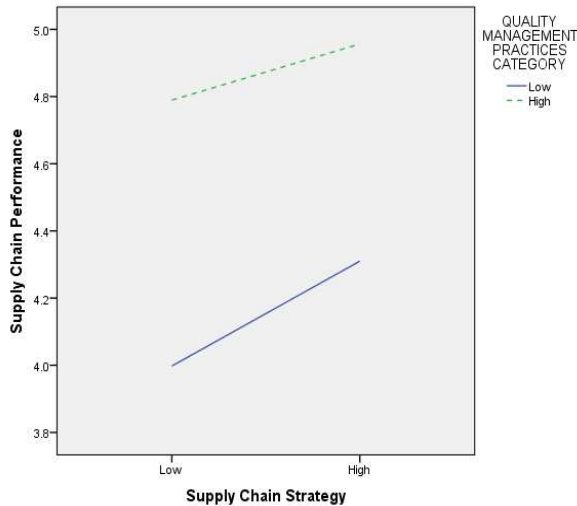

Figure 1. Relationship between Supply Chain Strategy and Supply Chain Performance

5.   Conclusions

The finding of this study statistically proved that at the high level of quality management practices, the influence of strategy on supply chain performance is lower compare to at low level of quality management practices. It can be concluded that quality management practices should be practiced at a high level, so it can improve supply chain performance compare low level quality management practices.

This finding also can be a guide for the supply chain improvement in an organization. For the success of supply chain, quality management practices should be emphasized. As shown by the result, when the practice of quality management moderates that relationship, the influence of strategy on supply chain performance was increased from 46.1 percent to 66.5 percent. In addition, the study also proves that at high level quality management practices can act as a strategy to improve supply chain performance.

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