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An empirical survey of supplier participation in sustainable green supply chain: a case study of Malaysian automotive manufacturers

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ABSTRACT

One of the controversial issues in the new world is climate change and environmental challenges in supply chain systems. Managers are trying to achieve green supply chain (GSC) by developing sustainable practices in supplier's participation. There is now a well-recognized need for achieving overall sustainability in industrial activities. The main goal of this paper is doing an empirical survey to achieve a better understanding of the drivers for the participation of suppliers in green supply chain initiatives. We selected four independent variables that are customer requirement, supplier readiness, relational norms and customer investment in a supplier system. Malaysian automotive industry was selected as a case of study. Final result showed that customer requirements will have a direct effect on supplier participation (H1). Moreover, it shown that there is a positive and important relationship between supplier readiness and supplier participation. In addition, our findings confirmed the hypothesis that there is not a significant relationship between relational norms and supplier participation. Finally, we found that there is not significant support in our data sample for Supplier development investment.

Keywords: Green supply chain management (GSCM), Sustainability, Suppliers, Automotive industry

INTRODUCTION

In today's word, climate change is one of the controversial issues that have received serious attention in the world. This issue voiced by academics and companies to focus on the sustainable activities. The strategy level that is developed by supplier for environmental management has a significant effect on the environmental performance of a company [1, 2]. Therefore, the final merchant of product faced with the considerable risk and the causing negative economic results. There are high levels of uncertainty at each SCM stages causing it to be known as a complex process [3]. In order to deal with the uncertainties and risks in all stages of the supply chain, particularly suppliers should try to provide competitive preferences to agree with social and environmental standards. It is necessary for forms to design effective strategies and techniques that encourage willingness in supplier to implement green supply chain approaches. Based on the investigations, there are some research works that assess different issues of green supply chain such as green market practices e.g. [4], marketing and operation management e.g. [5] and purchasing techniques e.g. [6]. There is a gap to conduct a practical study to evaluate the internal organization activities of suppliers particularly in the area of GSCM [7]. Therefore, it is necessary to study the supplier motivations and internal organizational processes in GSCM. Regarding to the work of Lee and Klassen [8] this paper aims to develop a conceptual framework to assess the factors for the suppliers that facilitate complying with GSCM initiatives. In order to develop a framework, a comprehensive survey among Malaysian

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manufacturing suppliers has been performed as a case of study. The paper is categorized as follows. First, the research framework and proposed hypothesizes are explained. Following that, the literature related to sustainability of supply chain and GSCM effect on the competitiveness is discussed. Then we show the research methodology and proposed research framework. Finally, we show the data analysis was done by SPSS software based on the final results.

Literature:

2.1 Sustainable Supply Chain:

Sustainable design is the philosophy of designing built environments and physical objects that conform, to the doctrines of ecological, social, and economic sustainability. Sustainable design aims to completely remove negative environmental impacts through sensitive and skillful design [9]. There are some parameters such as delivery, cost, quality and flexibility that participate in competition of firms' supply chain and operations [10]. Companies try to handle challenges on how to implement sustainability in their supply chain based on the importance of GSCM. There are some investigations that addressed several topics of sustainability in SCM such as green logistics strategies [11] or green purchasing [12]. In this paper we follow that the GSCM is an organizational approach that aids companies and their partners to make considerable profit by decreasing environmental risk and effects while improving ecological efficiency [13].

2.2 GSCM and Its Effect on Competitiveness:

Since the loss of reputation that firms suffered because of environmental problems that are caused by suppliers, the effect of green approaches on companies performance should not only be assessed based on the traditional SCM fields such as delivery, cost, quality and flexibility. The relation between green approaches and economic efficiency is more complex than a simple direct relation [14]. Companies decrease or minimize risk to loss of their reputation by considering a clear approach to green practices in combination with suitable supplier management [15]. In fact, green practices not only have an economic impact on internal operations but also help to identify external financial resources [16]. Investigations have shown that small and medium sized supplier companies have limited resources attainable to conduct efficient environmental capabilities [8]. Therefore, it is beneficial to study the drivers for supplier participation in GSC initiatives.

2.3 The Role of Sustainability in Automotive SC:

Automotive is very complicated product that needs a high degree of outsourcing to suppliers for their assembly [17]. Recently, car manufactures have comprehended the significant effect of environmental protection on the competitive advantage, particularly in Malaysia automotive industry. Attention for environmental aspects starts by introducing new approaches and technologies in the manufacturing process in close collaboration with suppliers. Although, the car manufacturers define the green standards themselves, sometimes they are improved together with key suppliers. Researchers are trying to find exactly how suppliers are engaged into GSCM activities. Existing investigations on sustainable supply chains in the car industry concentrated on operational factors such as individual manufacturing processes [18]. In one study, the critical role of suppliers in the evolvement of environmental friendly car was evaluated [19]. Another research evaluated the role of suppliers in the environmental improvement in the Canadian industry and indicated the significance of cooperation for supplier investment in environmental approaches [20].

2.4 Customer Requirements:

Customer as the major financial stakeholder has the ability to demand improvement in his supplier's environmental management practice [21]. It should be noted that, large customers put on ecological pressure in the supply chain to their suppliers, therefore expanding the exposure of upstream SC members to environmental principles. There are some standardized environmental managements systems such as ISO14001 that help to improve better environmental supplier performance [22]. In this paper we assume that GSCM requirements based on environmental performance improvement by the customers in SC is an important criterion for suppliers.

H1. Customer GSCM requirements have a positive effect on the role of suppliers to participate in GSCM initiatives.

2.5 Supplier Readiness:

Suppliers should be able to make the necessary changes based on green supply chain initiatives. Environmental consideration of managers can enhance the participation in GSM initiatives [13]. When managers determine and assess environmental problems, they will have to reply by assigning internal resources such as financial assets and manpower and effectively participate in greening the chain. Moreover, internal organizational learning, cross functional teams and communication in the organization can increase the awareness of the advantage of green activities. Additionally, culture and high degree of information sharing can enhance the environmental capabilities in organization [23]. Therefore, capabilities of suppliers such as internal characteristics, manager environmental awareness, availability of human, inter organizational communication and technical and financial resources, i.e. GSCM readiness can play a leading

role in GSCM initiatives.

H2. GSCM readiness of suppliers has a positive relation with green supply chain initiatives.

2.6 Supplier Relationship:

Cooperation in an organization can help to provide a long term relationship and increase the honest distribution of risks and rewards [24]. This issue can help to design and execution of inter organizational communication that are intend by supplier development. Supplier development aims at improving the supplier's performance and capabilities [2]. It also contains financial and technical assistance, training, incentives and awards of staff [25]. There are some investigations that showed a positive relationship between supplier development investments and cooperative relationship management [25, 26]. This paper considered the supplier relationship factor that has an important effect on the supplier development investments that cause to enhance the capabilities of suppliers to engage in GSCM activities.

H3. Supplier relationship in an organization has a positive relation with supplier development investments that help suppliers to engage in GSCM activities

2.7 Supplier Development Investment:

Supplier development initiatives have an important effect on the supplier performance supplier in a supply chain. Therefore, many companies try to provide supplier development investments to implement green criteria and lean practices [17]. Therefore:

H4. Supplier development investment has a positive relation with GSC initiatives.

Figure 1 shows the conceptual model of proposed framework.

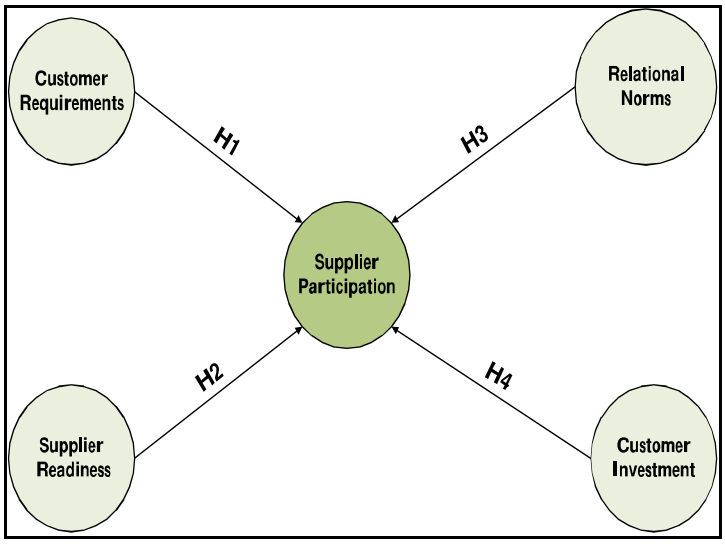


Fig. 1: Conceptual model

Materials And Methods

There are several methods and approaches such as computer simulation, statistical analysis and lean tools to improve the performance in different fields such as manufacturing systems, port container terminal, supply chain management and construction management which are not easy to model [27- 37]. But, In this paper the questionnaire that included 26 questions were designed based on previous studies. Supplier readiness (SR), customer requirements (CR) were selected based on Lee [8] and relation norms (RN) was selected from part of Vachon et al. [10 research also customer investment (CI) was selected from part of research of Narasimhan et al. [25] as factors that influence supplier participation (SP). The questionnaire was designed based on five-point Likert scales (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree). For understanding better of respondent's profiles four questions were added to the questionnaire such as respondent's age, sex, education and work experience. Prior to administering of survey the questionnaire was reviewed by two experts in the field of supply chain management and sustainability. The questionnaire was emailed to the automotive suppliers in Malaysia in Jun 2014. Malaysian automotive has faced several crucial environmental challenges such as transition or introduction particle filter to more energy efficient action.

The respondents were selected from 180 suppliers and response rate was maximized by conducting the following procedure [38]: direct request via telephone, repeated calling, emailing until yes/no decision was obtained, channeling the survey to the most appropriate manager, and participants

will receive results. In this way a total of 40 responses was collected and responded completely to the questions.

Data Analyzing:

4.1 Reliability Test:

The data was analyzed using SPSS software because it allows analyzing independent and dependent factors in the same time. For the reliability test the Cronbach's alpha test was used. According to Sekaran [39], Reliability test was used to indicate stability and consistency of instrument. In general, agreed rate of the lower limit for Cronbach's alpha is 0.70. The reliability test was done on collected data. The interior reliability of the supplier participation was tested by using the SPSS reliability analysis method. The summaries of the reliability analysis are shown in Table 1. In this table the reliability of each factor is showed. As a result, it shows that factors are reliable science, the alpha for all of them was greater than 0.70.

4.2 Correlation and Regression Analysis:

We examined the Pearson correlation matrix (see Table 2) to evaluate correlation validity between Independent factors and MSP as a depend factor. For doing this, at first the average of each factor was calculated by SPSS and after that the correlation analysis was done. The result of correlation analysis is shown in table 2. This table demonstrates Independent factors such as MCR, MSR, MRN and MCI and dependent factor as MSP. The Pearson correlation values are shown also the significant value is identified. As you can see in this table MSP has strongly significant relation with MCR, MSR and MRN by p-value<0.01 and it has rarely significant relation with MCI by p-value<0.05. The Pearson correlation values among MSP and MCR, MSR, MRN and MCI are 0.613, 0.514, 0.430 and 0.333 respectively that it shows that the highest Pearson correlation is belong to the MCR and MSP whereas the lowest correlation is about MSP and MCI. Also, in this table demonstrates there were no multi correlations between independent factors.

Table 1: Reliability Test Result

Factors	Item No	Cronbach's Alpha Values
Customer requirements	4	0.877
Supplier readiness	6	0.847
Relational norms	5	0.875
Customer investment	4	0.804
Supplier Participation	7	0.905

Table 2: Pearson Correlation Analysis

		MCR	MSR	MRN	MCI	MSP
MCR	Pearson Correlation	1	.238	.173	.201	.613**
	Sig. (2-tailed)		.139	.285	.213	.000
MSR	Pearson Correlation	.238	1	.380*	.105	.514**
	Sig. (2-tailed)	.139		.016	.520	.001
MRN	Pearson Correlation	.173	.380*	1	.226	.430**
	Sig. (2-tailed)	.285	.016		.162	.006
MCI	Pearson Correlation	.201	.105	.226	1	.333*
	Sig. (2-tailed)	.213	.520	.162		.036
MSP	Pearson Correlation	.613**	.514**	.430**	.333*	1
	Sig. (2-tailed)	.000	.001	.006	.036	
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

For achieving the more accurate and correct result the regression analysis was done for this data. The result of this analysis shows in table 3 and table 4. Table 3 shows the summary model of this regression analysis. As can be seen, there is one model with four predictors or constant such as MCI, MSR, MCR and MRN and one dependent factor as MSP. The value of R-Square was calculated by 0.587 and R=0.766.

Table 4 shows the amount of un-standardized and standardized coefficients for constants. The Beta value of MCR is the highest by 0.473 and p-value =0.000. The beta values and t values of each constant was shown in this table. Also the Sig column shows the amount of p-values for constant. The highest Beta and t-value is for MCR by Beta= 0.473 and t=4.154 and p-value<0.01 (sig=0.000) whereas the lowest value of Beta is for MCI by 0.161. Beta values for MSR and MRN are 0.311 and 0.19.

Table 3: Summary of Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.766a	.587	.540	.42170
a. Predictors: (Constant), MCI, MSR, MCR, MRN				
b. Dependent Variable: MSP				

Table 4: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.335	.520		-.643	.524
	MCR	.459	.110	.473	4.154	.000
	MSR	.293	.112	.311	2.604	.013
	MRN	.174	.108	.194	1.614	.115
	MCI	.153	.107	.161	1.427	.162

Discussion And Proposed Model:

The proposed model shows the relations between the drivers that were hypothesized in the research model. Coefficients (Beta, t and significance) and coefficients of determination (R2) together indicate how well the model performed. Figure 2 graphically represents standardizes coefficients for each hypothesis relationship (Beta). Dashed lines identify a path coefficient that does not significantly (p-value<0.1). Table 4 prepares the coefficients with Beta value and table 3 shows R square value.

It was hypothesis that customer requirements will have a direct effect on supplier participation (H1). The Beta coefficient from CR to SP (H1=0.473) is sharply significant (p-value <0.01). Hypothesis 2 indicates that supplier readiness is positively related with supplier participation. The coefficient from SR to SP (Beta= 0.311) is gradually significant (p-value<0.05). Hypothesis 3 shows the relationship between relational norms and supplier participation but is not significant relationship and not supported by our data (Beta= 0.194) and (p-value>0.1). We found no significant support in our data sample for H4 as a path coefficient from CI to SP (Beta=0.161, p-value>0.1) so it was not statistically significant. In conclusion, the model accounted for 58.7% (R2= 0.587) of the variance in supplier participation. Chin [40] explained this value as respectively moderate. Figure 2 shows the schematic view of developed framework results.

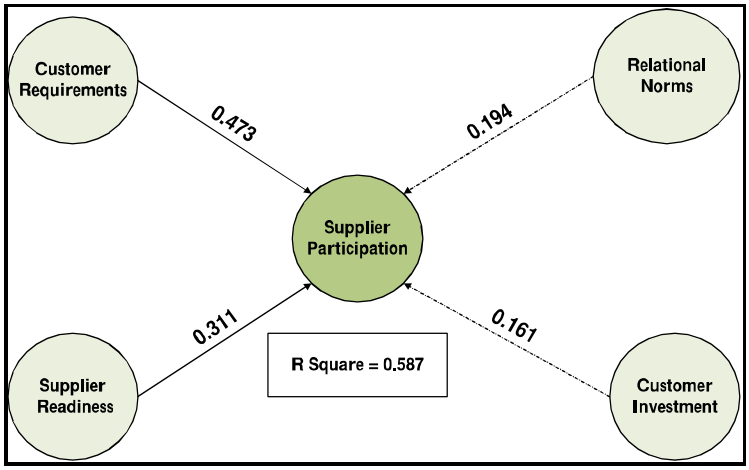


Fig. 2: Developed Framework Results

Conclusion:

One of the controversial issues in the new world is climate change and environmental challenges in supply chain systems. Managers are trying to achieve green supply chain (GSC) by developing sustainable practices in supplier's participation. There is now a well-recognized need for achieving overall sustainability in industrial activities. The main goal of this paper is doing an empirical survey to achieve a better understanding of the role of drivers for the participation of suppliers in GSC initiatives. Four independent variables were selected to evaluate in supplier participation, namely customer requirements, supplier readiness, relational norms and customer investment. The findings from our sample showed that customer requirements will have a significant effect on supplier participation (H1). Hence, meeting the GSCM requirements by customers in supply chain is an important driver for suppliers to participate in environmental performance improvement initiatives. A second finding of our study is the positive and significant relationship between supplier readiness and supplier participation. Our findings supported the hypothesis that there is not a significant relationship between relational norms and supplier participation. Finally, we found that there is not significant support in our data sample for Supplier development investment. We believe that this study has improve our understanding the role drivers of supplier participation in GSCM practices and has determined several vital issues that managers from Malaysian

automotive industry as well as supplier firms can adopt to obtain a more sustainable supply chain.

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