Interaction between Work System Performances with Process of Greening the Supplier

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ABSTRACT – This paper aims to discover the manufacturing performance level and the process in greening the supplier in implementing green supply chain initiatives. The relationship between the process in greening the supplier towards manufacturing performance also been investigated. For this reason, the data that was collected using questionnaire-based survey among Malaysian manufacturing firms were analysed using the factor analysis and correlation test. The result shows that the manufacturing performance through the implementation of green supply chain management has a positive relationship to supplier activities.

1. INTRODUCTION

Green supplier is defined as a vendor that provide and supply the material or products by monitoring and controlling their environmental performance [1]. As a motivation to appreciate the environmental, Green Supply Chain Management (GSCM) were conceived. As an integration of all system from the input transform to output, GSCM involves in linking of each element. In GSCM, manufacturers need to check and investigate all the suppliers' activities, mainly focus on ensuring the element of green was accomplished. According to Lee [2], GSCM is generally understood as a set of managerial practices to integrate environmental issues into supply chain management to ensure environmental compliance and to foster environmental capability of the entire Supply Chain (SC).

In manufacturing firms, SC is the requirement to handle the flow of raw material from the supplier through the value adding processes, and ended to the customer. Meanwhile, GSCM has been applied to control the flow of materials from suppliers, and emphasized on the awareness of environmental issues. For instance, poor environmental performance of small suppliers can affect badly the performance and image of buying companies [3]. In GSCM, supplier has become an important part in managing the good environmental protection. This is the main reason why manufacturing firms must take action in establishing a Green Supplier Model (GSM). Choosing a suitable GSM is critical. Thus, every factors need to be seriously considered to achieve the drives.

2. METHODOLOGY

The data were obtained from a structured questionnaire that was collect from 63 respondents by focusing to investigate how the Work System Performance (WSP) influences the process in Greening the Supplier (GS). The elements in WSP consists of lead time reduction, (WSP1), through-put time reduction (WSP2), work in progress reduction (WSP3), manufacturing cost reduction (WSP4), product quality improvement (WSP5), machine utilization improvement (WSP6), and flexibility improvement in process (WSP7). Each respondent who has more than 2 years of working experience at the same manufacturing organization is requested to identify and ranking for each statement in the questionnaire using four Likert scales, which reflect the practice and current performance of operations.

As for the elements in Greening the Supplier Strategy (GSS), eight elements has been considered. There are: Holding awareness seminars for suppliers/contractors (GSS1), Guiding suppliers to establish their own environmental programs (GSS2), Bringing together suppliers in the same industry to share their know how and problems (GSS3), Informing suppliers about the benefits of cleaner production and technologies (GSS4), Urging/pressuring suppliers to take environmental actions (GSS5), Choice of suppliers by environment Criteria (GSS6), Arranging for funds to help suppliers to purchase equipment for pollution prevention, waste water recycling, etc. (GSS7) and Sending in-house company auditors to appraise environmental performance of suppliers (GSS8).

3. RESULTS AND DISCUSSION

Factor analysis test was conducted to identify the number of latent factors underlying the WSP and GSS. The analysis was conducted using principal components analysis with varimax rotation with the eigenvalues of discontinuity greater than 1 and the loading factor exceeding 0.5. Varimax rotation methods were chosen because it can reduce the number of complex variables and improve yield expectations. [4].

For the WSP, all the elements were categories into one group as in Table 1. The WSP are closely related to

performance of the manufacturing performance. Based on this similarity, it is reasonable to justify this factor known as Work System Performance.

Table 1: Summary of WSP in Factor Analysis Test

Factor	Performance of Manufacturing System	Communalities	Factor Loading	Eigen Value	Cumulative %
Work System Performance (WSP)	WSP 2	0.691	0.831	3.484	58.06
	WSP 1	0.625	0.791		
	WSP 5	0.615	0.784		
	WSP 3	0.536	0.732		
	WSP 4	0.535	0.731		
	WSP 6	0.482	0.698		

For the GSS factor, it was extracted into two factors namely Guiding Supplier (GS) and Awareness (AW). Table 2 shows the summary of GSS in Factor Analysis Test. For GS, a total four indicators comprises of GSS3, GSS7, GSS2 and GSS4 were extracted into this factor at a loading value in between 0.657 to 0.862. This suggests that the administrative the supplier as the dominant factors that encouraging the supplier in green activities.

As for the AW, four indicators consist of GSS8, GSS6, GSS5 and GSS1 were extracted into this factor at a loading factor ranging from 0.630 to 0.894. The result suggests that in getting greening, supplier must also consider the awareness in intensification the knowledge in ensuring the green was implemented.

Table 2: Summary of GSS in Factor Analysis Test

Factor	Greening the Supplier	Communalities	Factor Loading	Eigen Value	Cumulative %
GS	GSS 3	0.755	0.862	3.967	49.589
	GSS 7	0.712	0.829		
	GSS 2	0.672	0.762		
	GSS 4	0.499	0.657		
AW	GSS8	0.815	0.894	1.319	66.071
	GSS6	0.643	0.795		
	GSS5	0.614	0.709		
	GSS1	0.575	0.630		

The Spearman correlation test was performed to identify the relationship between GSS and WRP. Table 3 shows the correlation coefficient result. The highest correlation is between WSP4 and GSS4 (0.292). This shows that Manufacturing Performance in cost reduction is has a positive correlation with informing suppliers about the benefits of cleaner production and technologies. Meanwhile, WSP3 and GSS7 (-0.053) shows that Work in Progress Reduction is negatively correlated with arranging for funds to help suppliers to purchase equipment for pollution prevention, waste water recycling.

Table 3: Correlation Spearman Coefficient of WSP and GS

FACTOR		GS			
		GSS3	GSS7	GSS2	GSS4
WSP	WSP1	0.197	0.088	0.157	0.194
	WSP2	0.102	0.020	0.032	0.166
	WSP3	0.160	-0.053	0.078	0.230
	WSP4	0.186	0.096	0.042	0.292(*)
	WSP5	0.288(*)	0.176	0.236	0.245
	WSP6	0.128	0.096	0.153	0.171
	WSP7	0.131	0.052	0.024	0.110

Table 4 shows the correlation coefficient result between WSP and AW. The highest correlation is between WSP2 and GSS6. This suggests that manufacturing performance in throughput time reduction is positively correlated with choice of suppliers by environment criteria. Meanwhile, the lowest correlation is between WSP5 and GSS5 at correlation value of 0.070. Its show Manufacturing Performance in machine utilization improvement has a weak correlation with Pressuring supplier to take environment action.

Table 4: Correlation Spearman Coefficient of WSP and AW

FACTOR		AW			
		GSS8	GSS6	GSS5	GSS1
WSP	WSP1	0.226	0.354(**)	0.193	0.231
	WSP2	0.320(*)	0.453(**)	0.223	0.196
	WSP3	0.184	0.257(*)	0.173	0.113
	WSP4	0.374(**)	0.289(*)	0.258(*)	0.178
	WSP5	0.281(*)	0.283(*)	0.070	0.248
	WSP6	0.242	0.323(*)	0.086	0.186
	WSP7	0.207	0.161	0.127	0.128

4. CONCLUSIONS

In conclusion, the interaction of performance and supplier still needs an improvement. From the results, the level of WSP is influenced by the activities of suppliers. In greening the supplier, it was hope that the performance of manufacturing will increased. These findings are useful in establishing the strategy and setting the actions required in achieving high level of green practices in manufacturing firms.

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