

“GREEN BUSINESS PROCESS MANAGEMENT” IN MANUFACTURING FIRMS: EXAMINING THE ROLE OF UPSTREAM AND DOWNSTREAM SUPPLIERS

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***Abstract:** This research is undertaken with the aim of examining the influence of green supplier selection, green supplier monitoring and green supplier collaboration towards green business process management (GBPM) amongst Malaysian manufacturing corporations. Using the resource based view theoretical lens, a survey was conducted on 122 manufacturing corporations in Malaysia. The empirical analysis using the Partial Least Square (PLS) modeling technique revealed that green supplier monitoring and green supplier selection have a significant influence towards effective GBPM in the sample of manufacturing corporations. The influence of green supplier collaboration on the other hand is not significant.*

***Keywords:** Environmental Protection, Green Initiatives, green supplier monitoring, green supplier selection, green supplier collaboration*

INTRODUCTION

Environment protection is the buzz word in today's corporate world. To this end, green business process management (GBPM) is recognized as one of the best managerial practice to protect the environment. The fundamental argument of this paper is that whilst GBPM is contingent upon a corporation's internal practices, the role of upstream suppliers in facilitating effective GBPM is pivotal. Efficient integration of internal and external green business practices could accentuate the GBPM. External green business practices here refer to the upstream suppliers' green business practices. In essence corporations with GBPM would need to select, monitor and collaborate with suppliers (both upstream and downstream) of green practice nature.

Green Suppliers Selection refers to selection of suppliers strategically, factors beyond price should be considered: a supplier's financial performance, strategic alignment, speed of design, ability to design, and production capacity, among others in context of green business process management (Ellram, Liu 2002; Sarkis & Talluri, 2002). Green Suppliers Monitoring is defined as the acquisition of knowledge about the strengths and weaknesses of each supplier in context of green

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business process management (Carr & Pearson, 1999). Green Suppliers Collaboration refers to any systematic effort, from selecting good suppliers to developing capabilities in the base of suppliers that creates and maintains a competent base of supplier's in line with green business process management practice (Hahn *et al.*, 1990).

The issue of ecosystem disruption, pollution and resource depletion is giving manufacturing industry greater pressure to conform to environmental standards and guidelines as a mean to address environmental sustainability (Chen & Sheu, 2009). Manufacturing companies is known to be one of the highest polluters of the environment through its supply chain activities such as procurement, production and distribution (Fiksel, 1996; Eltayeb *et al.*, 2011). Manufacturing companies are thus required to implement mechanisms at the corporate and plant level to assess and reduce environment pollution occurring in its supply chain, including upstream and downstream networks (Wooi & Zailani, 2010).

In lieu of the heavy pollution made by manufacturing industries, effective management of a manufacturing corporation's business processes following green practices is not widely debated in the literature (with exception to Carter & Jennings, 2002; Srivastava, 2007). Green business process management entails managing a manufacturing corporation's supply chain by conforming to green standards and practices. The management of a corporation's green business process also involves management of the corporation's upstream supply chain - which is essentially the management of manufacturing company suppliers' and sub-suppliers. This is because managing internal green processes can become effective if external parties' practices are also green.

Another research gap in the literature is that the little available studies provided a cursory perception of green business process management than a detailed process model that can help managers to implement green business process management effectively. This research takes a significant step towards filling this gap by looking at green business process management influencing factors in Malaysian manufacturing industry as one plausible way to tackle environment sustainability in the country. Therefore the primary objective of this study is to examine the extent Green Business Process Management (GBPM) among Malaysian manufacturing industries based on green supplier selection, green supplier monitoring, and green supplier collaboration.

The reminder of this paper is; section 2 reviews the previous works, section 3 discuss the methods applied; section 4 presents the empirical findings and discussion while section 5 concludes.

LITERATURE REVIEW

According to the Mentzer *et al.* (2001), supply chain is defined as the formation of firms putting effort together in a network that needs constant upgrade in terms of

operations and capabilities, both upstream and downstream right from the point of raw material to end-user consumption. Besides environmental regulations, investing into green supply chain management (GSCM) can help firms to save resources, eliminate waste and improve productivity (Porter and Van Der Linde 1995). Thus, it also improves flexibility and efficiency in conducting business (Wilkerson, 2005). Subsequently, this enables creation of new innovations on product and services both for supplier and customer market and better involvement of internal and external stakeholders in the process of decision making.

GSCM is defined as ‘integrating environmental thinking into supply-chain management, which includes product design, sourcing for raw material and choosing process of manufacturing, delivery of end product to customers, and end-of-life management of product upon ending its product life span (Zhu and Sarkis, 2004; Srivastava, 2007). The important issue in GSCM refers to the tools used in GSCMs and the necessity for their implementation. Even though an organization is in light of possible environmental improvements and value creation, the full capacity of green supply chain can only be achieved by having a close relationship with suppliers and customers which in return bring the traditional meaning of supply chain which was initially based on the relationship between direct suppliers and customers (Kumar and Yamaoka, 2006; Vachon and Klassen, 2006a).

Besides all above, it is crucial to have knowledge on the degree of partnership between important stakeholders to evaluate the usefulness of green supply chains. Vachon (2007) have successfully studied the relationship between green supply chain practices and the criteria to choose type of environmental technologies. Moreover, Vachon (2007) observes the relative between environmental relationships and environmental observing in supply chain. Their end results recommend that environmental alliance with suppliers is positively related with higher investment in pollution stoppage technologies while the same type of alliance with customers has no effect on the implementation and acceptance of pollution stoppage technologies.

Supply chain is defined by Chopra and Meindl (2007) as all parties involved in providing satisfaction to customers by fulfilling a customer order. Companies at most times might not hold control over decision making as sole party involved in managing resources, information, and/or process. Supply chain management on the other hand is defined as the control over supply chain operations, resources, information and funds to capitalize on supply chain profitability or surplus-the difference between the profit derived from a customer’s order and all costs sustained by the supply chain while fulfilling customer’s order. Meanwhile, business sustainability is defined as conducting business with a long term goal to sustain welfare of the economy, environment, and society.

Green Business Process Management

Green Business Process Management refers to a plant's institutionalization of internal environmental management practices (Zhu *et al.*, 2008), and this institutionalization can include such activities as design for the environment, pollution prevention (reduction at the source), pollution control (end-of-pipe technologies), and "Environmental Management System" (Klassen & Whybark, 1999a,b). If implemented effectively, green management programs improve a plant's environmental performance (King & Lenox, 2001).

In some cases, industry itself is already enforcing green management practices (Barnett & King, 2008), but internal environmental programs should also go upstream in a supply chain, either because "Environmental Management System" itself requires it (Corbett & Klassen, 2006) or as a result of mimetic isomorphism (DiMaggio & Powell, 1983). Thus it is expected that Green Business Process Management provides the basic capabilities required to implement GSCM.

Green Supplier Collaboration

Green Suppliers collaboration is defined as any systematic effort, from selecting good suppliers to developing capabilities in the base of suppliers that creates and maintains a competent base of suppliers in context of green business process management practices (Hahn *et al.*, 1990). Here, the focus is on environmental cooperation at the high end of the spectrum of possible activities for supplier development, i.e., the development of joint capabilities that enhance environmental performance on a more competitive scale as opposed to just any kind of collaboration, such as collaborative production planning. A number of studies have found that both external factors such as client demands and such internal factors as the support of senior management are important determinants of environmental relationships with suppliers (Carter & Carter, 1998; Narasimhan and Carter, 1998). Environmental collaboration with suppliers, therefore, requires a substantial commitment of resources and organizational capabilities. Supplier collaboration is a learning and knowledge intensive process, and thus would be present in plants with sophisticated management systems, such as those with Green Business Process Management. Hence the related hypothesis for this variable can be written in form of alternative as; H1: Green Supplier Collaboration has a significant impact on effective green business process management in Malaysian manufacturing companies.

Green Suppliers Monitoring

The process of green supplier monitoring is defined as the acquisition of knowledge about the strengths and weaknesses of each supplier in line with green business process management practices (Carr & Pearson, 1999). Thus environmental monitoring of suppliers assesses their environmental practices (resources and

capabilities) and environmental outcomes (performance). In some circumstances, the environmental monitoring of suppliers is one of the most efficient ways to improve their environmental performance (Green *et al.*, 1998) because changing supply policy practices with current suppliers requires more organizational resources than selecting suppliers on the basis of their environmental performance. Consistent with the RBV's path-dependence logic, managers of plants with high levels of GBPM will probably have mature environmental and quality systems in place and will start looking at their current supply base in search of opportunities to improve the environmental performance of their suppliers. Thus the following hypothesis can be developed for this issue; H2: Green Supplier Monitoring has a significant impact on effective green business process management in Malaysian manufacturing companies.

Green Suppliers Selection

The portal for a supplier into a supply chain is the process of green suppliers' selection (Choi & Hartley, 1996). When selecting suppliers strategically, factors beyond price should be considered: a supplier's financial performance, strategic alignment, speed of design, ability to design, and production capacity, among others in line with green business process practices (Elra, Liu 2002; Sarkis & Talluri, 2002). Supplier selection emphasis has already shifted from price to quality of materials in some markets. Because implementing supplier selection policies on the basis of environmental performance does not involve the current base of suppliers, policies governing supplier selection are easy to change and require the least commitment of organizational resources. In some cases, supplier selection is the only point at which environmental policy is included in the supply process (Gavronski *et al.*, 2006). A review of the literature showed no studies in supply management that link Green Business Process Management and supplier selection in context of Malaysian manufacturing companies. Thus the following hypothesis can be proposed; H3: Green Supplier Selection has a significant impact on effective green business process management in Malaysian manufacturing companies.

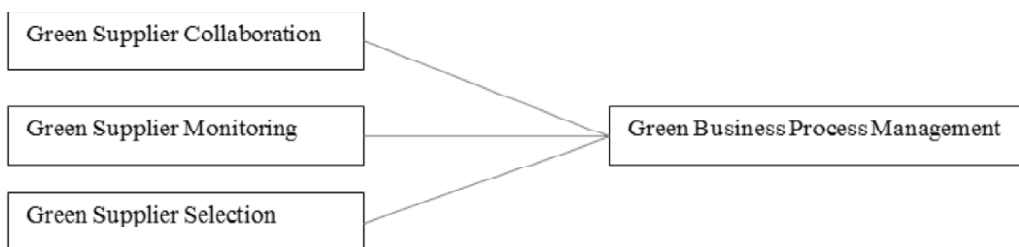
Theoretical Model

This study is based on the resource-based view of the firm (RBV) (Barney, 1991), a theoretical lens that postulates companies develop capabilities from their base of existing resources. The resource-based view (RBV) as a basis for a competitive advantage of a firm lies primarily in the application of the bundle of valuable resources at the firm's disposal. Based on the RBV concept, this research conceptualizes the nature of three specific resources, namely Green Suppliers Collaboration, Green Suppliers Monitoring and Green Suppliers Selection into the RBV concept. These three green practices are part of the green supply management initiative.

Green Suppliers Collaboration (GSC) possesses valuable and non-substitutable characteristics because a green business practice that promotes extensive collaboration with upstream and downstream suppliers can be regarded as a valuable practice resulting in competitive advantage and non-substitutable. Organizations adapting to Green Business Process Management especially would be able to compete significantly if they possess such valuable business practice (resource). Green Suppliers Monitoring (GSM) is about monitoring the green practices by suppliers throughout the supply chain process. This practice is a rare element for manufacturing firms especially. A manufacturing firm that monitors its suppliers' green practice adoption (such as processing using green raw materials, using recycled resources, and reduce waste) possesses a practice that is unique or rare. Not all organization of green business practice would want to go to the extent of monitoring their suppliers as this involves cost and time. Thus, having such practice will certainly be characterized as rare.

Green Supplier Selection (GSS) is about selecting suppliers who follows green processes. GSS is conceptualized as In-imitable and valuable resource because a company that practices green process management would have greater potential to compete in market due to their in imitable and valuable practice of selecting suppliers who are also green in their practice. Customers with green practice would identify and patronize green business. Given in a competitive market green based customers would want to patronize manufacturers who are full-fledged green business practitioners. Full-fledged green business practitioners refer to the organization selecting their own suppliers who are also adopting green practice. Promotion of being a green business would be futile without adopting a full-fledged green business practice and this can lead to competitive advantage. Figure 1 shows the theoretical framework of the paper.

Figure 1: Research Model



METHODOLOGY

In this study, author have chosen to post the questionnaire to respondents who are from manufacturing companies listed under Federal Malaysian Manufacturing (FMM) directory. The questionnaire will be addressed to the plant manager or

equivalent decision makers in the manufacturing sector. The quantitative data obtained in this study will be subjected to the estimations using structural equation modeling (SEM) via the partial least square (PLS) technique. The measures for environmental relationships with suppliers will be measured using a set of three items adapted from Vachon and Klassen (2006b).

EMPIRICAL FINDINGS

A total of 122 responses are collected and analyzed. Table 1 shows the summary of respondents’ profile (demographic).

Table 1
Summary of Respondents Profile (n = 122)

<i>Variables</i>	<i>Category</i>	<i>Frequency</i>	<i>Valid Percentage (%)</i>
Current Role	Executive	67	54.9
	Manager	41	33.6
	Director	9	7.4
	Chairman	5	4.1
Years Working	1 to 3 Years	44	36.1
	4 to 6 Years	31	25.4
	7 to 9 Years	26	21.3
	More than 10 Years	21	17.2
Years Firm Operating	1 to 3 Years	12	9.8
	4 to 6 Years	25	20.5
	7 to 9 Years	42	34.4
	More than 10 Years	43	35.2
Full-Time Employee	0 to 49	30	24.6
	50 to 99	28	23
	100 to 249	33	27
	250 to 499	23	18.9
	More than 500	8	6.6
Ownership Structure	Private Ltd	108	88.5
	Public Ltd	14	11.5
Average Gross Revenue	< \$5m	29	23.8
	\$5m to \$10m	28	23
	\$11m to \$15m	34	27.9
	\$16m to \$20m	18	14.8
	>\$20m	13	10.7

Assessment of Reliability

To test the reliability of the data, reliability test is conducted. The data is considered to be acceptable if the Cronbach alpha value is more than 0.7 (Hair *et al.*, 2010). In this study, all data collected was tested separately and all the data recorded values from 0.7146 to 0.9086. As a result, we can see that all constructs within this research are reliable.

Table 2
Summary of Reliability Test

<i>Constructs</i>	<i>Items</i>	<i>Cronbach's Alpha</i>
Green Business Process Management	C1, C2, C3, C4, C5	0.7251
Suppliers Collaboration	A1, A2, A3, A4	0.9086
Suppliers Monitoring	A6, A7, A8, A9	0.7329
Suppliers Selection	A11, A12, A13, A14	0.7146

PLS Outer Model Evaluation

The research model in this study has four reflective constructs which are Supplier Collaboration, Supplier Monitoring, Supplier Selection and Green Business Process Management (the latter as dependent factor). Table 3 and 4 illustrates the results of outer model evaluation of reflection construct (i.e., convergent validity: individual item reliability, composite reliability and AVE; and discriminant validity: correlation and AVE²).

Table 3
Statistical Results of Outer Model Evaluation

<i>Construct</i>	<i>Indicator</i>	<i>Loading</i>	<i>Composite Reliability</i>	<i>AVE</i>	<i>AVE²</i>
Green Business Process Management	C1	0.633			
	C2	0.707			
	C3	0.754			
	C4	0.711			
	C5	0.640	0.82	0.51	0.71
Suppliers Collaboration	A1	0.851			
	A2	0.928			
	A3	0.922			
	A4	0.827	0.93	0.78	0.88
Suppliers Monitoring	A6	0.699			
	A7	0.749			
	A8	0.746			
	A9	0.781	0.83	0.55	0.74
Suppliers Selection	A11	0.624			
	A12	0.832			
	A13	0.680			
	A14	0.623	0.80	0.51	0.71

Table 4
Statistical Results of Outer Model Evaluation

<i>Correlations of Latent Variable</i>	<i>Green Business Process Management</i>	<i>Supplier Collaboration</i>	<i>Supplier Monitoring</i>	<i>Supplier Selection</i>
Green Business Process Management	1.00	-	-	-
Supplier Collaboration	0.19	1.00	-	-
Supplier Monitoring	0.52	0.15	1.00	-
Supplier Selection	0.49	0.0016	0.58	1.00

The result of reliability assessment on the four reflective constructs showed that there were few indicators within the four constructs that had a loading value smaller than 0.50 thresholds, therefore these values were removed as per Chin’s (1998) suggestions. The indicators that were removed are A5 (Supplier Collaboration), A10 (Supplier Monitoring) and A15 (Supplier Selection). Once the indicators are removed the outer model was re-evaluated. The composite reliability, AVE, AVE² and correlations showed in Table 3 and 4 are the values archived after removing the weak indicators which had factor loading lower than 0.50. The other indicators displayed satisfactory loading values and provided adequate explanatory power for the model.

The composite reliability values of all four reflective constructs were more than 0.80 threshold values in the model. Moreover, the AVE values for all four constructs are above 0.50 cut-off points indicating there’s a good relation between the constructs and its indicators. As for discriminant validity, the AVE² values were higher than the correlations between the independent constructs which justifies that the constructs are valid and reliable.

Structural (Inner) Model Evaluations

As the convergence and discriminant requirements were fulfilled in outer model evaluation with the estimated values for all tests at acceptance level, the structural inner model will be evaluated and will be tested in this section.

Table 5
Structural (inner) Model Evaluation

R ² = 0.345	
SC → GBPM (H1)	0.137 (1.512)
SM → GBPM (H2)	0.319 (3.045) **
SS → GBPM (H3)	0.308 (2.917)**

Notes: ** p < 0.05, SC = Supplier Collaboration; SM = Supplier Monitoring; SS = Supplier Selection; GBPM = Green Business Process Management

Hypotheses Testing

Table 5 above shows that the structural association between Supplier Collaboration and Green Business Process Management is weak as the path is not statistically significant ($\beta = 0.137$; $t = 1.512$). Therefore, first hypothesis is not supported. In context of second hypothesis, the structural linkage estimation is positive and significant. The path relationship between Supplier Monitoring and Green Business Process Management is statistically significant at 5% level ($\beta = 0.319$; $t = 3.045$). Therefore, second hypothesis is well supported with these values. The structural linkage estimation is also positive and significant for supplier selection. The path relationship between Supplier Selection and Green Business Process Management is statistically significant at 5% level ($\beta = 0.308$; $t = 2.917$). Therefore, third hypothesis will be accepted. Table 6 shows the summary of outer model selection.

Table 6
The Summary of the Outer Model Estimation

<i>Path Relationship</i>	<i>Accept/Reject Hypothesis</i>
H1	Reject hypothesis
H2	Accept hypothesis
H3	Accept hypothesis

DISCUSSION

The overall empirical result shows that the relationship between supplier collaboration and green business process management is not statistically significant ($\beta = 0.137$; $t = 1.512$). A study of similar nature by Gavronski *et al.* (2006) however found supplier collaboration to be an important element for Green Business Process Management. The relationship between supplier monitoring and Green Business Proses Management is positive and statistically significant ($\beta = 0.319$; $t = 3.045$). This result is similar with other research work on this issue such as Gavronski *et al.* (2006) who showed a significant relationship between supplier monitoring and Green Business Process Management in Canada. The relationship between supplier selection and Green Business Process Management is positive and statistically significant ($\beta = 0.308$; $t = 2.917$). This result is similar with other research work on this issue such as Gavronski *et al.* (2006) who showed a significant relationship between supplier selection and Green Business Process Management in Canada.

The t-statistical obtained from bootstrapping procedure in PLS modeling indicates A12 with the highest t-statistic value ($t=18.216$). This implies that the sample respondents of Malaysia's manufacturing companies are very inclined in having their potential primary suppliers to have implemented environmental management system (e.g. ISO 14004). The result also indicates A11 with the lowest t-statistic value ($t=6.198$). This implies that the sample respondents of Malaysia's

manufacturing companies are having less concern on requesting potential primary suppliers to provide evidence of all environmental licenses and permits.

CONCLUSION

Currently in Malaysia, Green Business Process Management has become an important area under Green Supply Chain Management. The relevant government bodies are giving incentives to companies of these industries so that more and more companies will start implementing this whereby this will increase "Green" concern in companies. Similarly, these scenarios reflect to the aim of this study since "Green" practice should not only be implemented in the firm but should start from the supplier itself so that the whole process will be practiced in a green manner.

Three research objectives were developed to achieve the goal of this study. The objectives are to examine the supplier monitoring, suppliers' collaboration, and selection of suppliers' effectiveness on green business process management in Malaysian manufacturing companies. The supplier collaboration objective was not met as the results shows that there is no significant relationship between Supplier Collaboration and Green Business Process Management. The result of first and third objectives shows that there is a significant influence between Supplier Monitoring and suppliers' selection with Green Business Process Management.

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