A CAUSAL RELATIONSHIP MODEL OF GREEN SUPPLY MANAGEMENT AND COMPETITIVENESS

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Introduction

In the past, supply chain management (SCM) as a business function was concerned mainly with only bottom-line financial considerations. However, for more than two decades many purchasing and supply chain professionals have understood the impacts that purchasing and SCM have on social, economic and environmental processes and systems. The term “triple bottom-line” becomes an accepted objective in the business community. Research in this area has consistently shown that professional purchasers and SCM managers who consider environmentally preferable criteria in the procurement have the influence to reduce or even eliminate waste and environmental impacts as well as reduce costs. In fact, global experience and examples show how environmentally preferable criteria early in the procurement process improve the organizations’ environmental performance, while addressing ethics, social and economic concerns.

Overall, the implementation and integration of green SCM concepts which contributes to an organization’s green procurement can allow an organization to prevent or reduce financial and environmental risk. Alternatively, organizations may want to involve their suppliers at the design stage or develop a supplier network and pre-qualify suppliers that have responsible environmental management. Green purchasing should bring many important benefits for its practitioners: better corporate image, risk management, production efficiency, stronger supplier relationships, improvements in environmental performance, and enhancing business competitiveness.The concept of supply management is broader than purchasingor procurement. However, in this study the investigation will be restricted to green purchasing decision, supplier selection, cooperation and relationship with suppliers. A theoretical model will be presented to explain the impacts of the commitment to environmental policy and social responsibility on the competitiveness of business firms. The model is assessed by survey data from manufacturing and service companies in Thailand. This paper examines the following research questions:

RQ1. Does commitment on environment have impact on firms’ competitiveness?
RQ2.How management support and employee participation impact on green supply management?
RQ3.Do corporate social responsibility and corporate image has impact on green purchasing?

Literature Review

Green CSR and Competitiveness

Since the Intergovernmental Panel on Climate Change (IPCC) released the first assessment report in 1990 citing "unequivocal" proof of global warming caused by man-made emissions of greenhouse gases,many of the big corporations in the world have adopted highly visible "green" strategies, embracing environmentalism in their business operations. These corporations understand that part of their role is to be socially responsible motivated by desire to do what is right. It is not just an attempt to polish their public image and fend off government regulation. Research shows that in a competitive market, the perception about corporate social responsibility (CSR) can be a major differentiation point for companies, but it must be a sincere, deeply held element of the corporation's culture. The rewards for adopting environmentally sound policies within a corporation may take a long time to become clear. However, in the long term, it is believed that companies can profit from well-designed strategies that embrace environmental responsibility with their corporate image. With increasing environmental regulations firms are expected to fulfill socially responsible business practices (Cetindamar, 2001; Pilkington and Dyerson, 2006). In an effort to address supply chain activities centered on environmental awareness, there has been a research stream, green supply chain management, which conceptualizes commitment on environment initiatives (Srivastava, 2007).

The relationship between green supply chain management(GSCM) and economic results has been increasingly studied by researchers. Klassen (1993) and Preuss (2002) argued for integrating environmental issues into the mainstream of SCM. Handfield et al. (1997) suggest that environmental sustainability efforts be integrated throughout the value chain. Whether going “green” really pays has been investigated with some inconclusive results (King and Lenox, 2001; Rao and Holt, 2005). Seuring (2004) questioned whether the adoption of environmental sustainability results in environmental and economic tradeoffs for the supply chain partners. However, there are also empirical studies which show positive relationship between environmental performance and business performance (Hervani et al., 2005; Albino et al., 2009). These studies support the thesis that green performance driven by environmentally conscious supply chain practices also enhances firms’ competitiveness. Recently,

researchers has proposed that successful implementation of GSCM practices such as green purchasing, cooperation with customers, eco-design, and investment recovery will lead to improved environmental and economic performance which support improved operational and organizational performance (Green et al., 2012; Lee et al., 2012).

Green Purchasing

Green purchasing is the method wherein environmental and social considerations are taken with equal importance, if not more, to the price, availability and performance criteria used to make purchasing decisions. Green purchasing is also known as "environmentally preferred purchasing (EPP), green procurement, affirmative procurement, eco-procurement, and environmentally responsible purchasing.Green purchasing has been defined as an environmentally conscious purchasing initiative that tries toensure that purchased products or materials meet environmental objectives set by thepurchasing firm. Examples of the objectives are reducing the sources of wastages, promoting recycling, reuse,resource reduction, and substitution ofmaterials (Min and Galle, 2001;Zsidisin and Siferd, 2001). In other words, green purchasing ensures that purchasing or supply chain managersconsider the issue of environmental sustainability in the purchasing of inputs, in addition to thetraditional purchasing criteria of cost, quality, and delivery (Jimenez and Lorente, 2001;Kannan et al., 2008). Research in green purchasing gains more attention along with green supply chain management. ElTayeb et al. (2010) studied the drivers for green purchasing of Malaysian firms with certified ISO 14001. They found international regulations, customer pressures, and expected business benefit having different influences on the green purchasing adoption.

Hamner (2006) summarized some basic green purchasing activities which were in common practicesas follows:

(1) Product content requirements. Buyers specify that purchased products musthave desirable green attributes such as recycled or reusable items instead of wastes.

(2) Product content restrictions. Buyers specify that purchased products must notcontainharmful materials or environmentally undesirable attributes such as lead, CFCs, plastic foam in packaging materials.

(3) Product content labeling or disclosure. Buyers require disclosure of theenvironmental or safety attributes in the contents of the purchased product. Suchdisclosure can be done using green seals and indicators of relative environmentalimpact such as scientific certification system offered by various accepted certificationorganizations.

(4) Supplier questionnaires. Buyers send questionnaires to suppliers asking themto provide information about their environmental aspects, activities and/ormanagement systems.

(5) Supplier environmental management systems. Buyers require suppliers todevelop and maintain an EMS. The buyer may require the supplierto certify the system.

(6) Supplier certification. Buyers require suppliers to have an EMS that is certifiedas fully compliant with one of the recognized international standards such asthe ISO 14001, and the European Union's Restriction of Hazardous Substance (RoHS) directive, Eco-Management and Audit Scheme.

(7) Supplier compliance auditing. Buyers audit suppliers to determine their level ofcompliance with environmental requirements.

Supplier Selection

The identification and analysis of criteria for selection and evaluation of vendors has been the focus of attention for many academicians and practitioners. In his seminal work, Dickson (1966) conducted a questionnaire survey mailed to about 300 commercial organizations in the US, primarily manufacturing firms. The purchasing managers of these firms were asked to identify factors that were important for selecting suppliers. The factors ranked according to usage by the organizations are quality (96.6%), price (93.9%), delivery (93.9%), service (81.8%), technical capability (63.6%), financial strength (51.5%), geographical location (42.4%), reputation (42.4%), reciprocal arrangements (15.1%) and other factors(12.1%).Cheraghi et al. (2004) studied the critical success factors for supplier selection of 110 research papers between 1966 to 2001. They concluded that selection criteria continued to change based on an expanded definition of excellence. However, non traditional criteria such as factors representing environmental and CSR issues did not even exist in the list. In recent years, as increasing environmental awareness has favored the emergence of the new green supply chain paradigm,green criteria have been incorporated in the supplier selection decision. In particular, the focus is the incorporation of corporate social responsibility (CSR) and environmental responsibility requirements into supplier selection. Tuzkaya et al. (2009) identified 6 major criteria: pollution control, environmental and legislative management, green product, green image, environmental costs, and green process management". Awasthi et al. (2010) proposed 12 environmental criteria: use of

environmental friendly technology, use of environmental friendly material, green market share, partnership with green organization, management commitment, adherence to environmental policies, green R&D projects, staff training, lean process planning, design for environment, environment certification, and pollution control initiatives. Wong et al. (2012) extended the criteria to include both environment and CSR for supplier selection.

Supplier relationship

Supplier relationship has been classified into three types. Transactional relationships are the most common and the most basic type of buyer/supplier relationship. This relationship is referred to as an arm's-length relationship where neither party is concerned about the other parties well being. There is very little trustinvolved in this relationship and it could be a one time transaction between the buyer andsupplier.A collaborative relationship is one of mutual benefit to both parties. There is avarying level of trust, but some is required. Companies will cooperate and work together for increased savings and future innovations. As trust and participation are important elements for success, collaborative relationships must be fully supported from the entire organization. A buyer must have the authority to negotiate with a supplier and come to an agreement that carries mutual trust and benefit. The third type of buyer-supplier relationship is the alliance relationship. An alliance isformed for a systematic approach to enhance communication between the two firms. Unlike collaborative relationships, an alliance is built to have a strong trust where both firms can be on the same level and help each other out when needed.

Supplier cooperation and relationship has been a common practice in successful SCM. Extending the supplier relationship from economic-based activities to environmental programs is also becoming common. Greensupply chainmanagement is to enhance firms' environmental performance throughinter-organizational collaboration with business partners and increase efficiency bycost saving programs and proactive risk management practices (Rao and Holt, 2005). Acollaboration in green management supports inter-organizationalinnovation practices throughout the supply chain from concept to disposal (Gerrard andKandlikar, 2007; Hong et al., 2009).External coordination with customers and suppliers from product concept to disposal (Linton et al., 2007), and involvement of suppliers are required from the earlystage of product development (Huang and Mak, 2000; Gerwin and Barrowman, 2002;Koufteros et al., 2007).

The Research Methods

The literature review provides a theoretical framework to investigate the relationships among firms' commitment to environment, green supply management and firms' competitiveness in this study. A set of hypotheses was developed with a structural model for the statistical analysis. The hypotheses are:

H1a. Firms with strong commitment to environmental policy and implementation tend to have higher level of management support and employee participation in environmental management.
H1b. Firms with strong commitment to environmental policy and implementation tend to have higher practice of green purchasing.
H2. Firms with higher CSR and conscious about corporate image tend to have higher practice of green purchasing.
H3. A firm's level of management support and employee participation in the environmental management is positively related to the level of green cooperation and relationship with its suppliers.
H4.Green purchasing decision is positively related to better cost and competitiveness.

The data for the analysis were collected from both manufacturing and service companies in Thailand with 149 respondents and the demographic summary is as follows.
. Types of business: Manufacturing (83), Service (66)
. Number of employees: Less than 500 employees (73), Equal or more than 500 employees (76)
. Certified Environmental Management System (ISO 14001): Yes (95), No (54)
. Location inside an industrial estate: Yes (85), No (64)
. Business operations: International (122), domestic only (27).

A questionnaire using 1 to 5 point Likert scale was developed to measure the response from the sample companies. The model constructs and theirdefinitions are listed in Table I. The measurement itemdescriptions and variables are listed in Table II.Descriptive statistics obtained by using the SPSS softwarearealso presented in Table II. All measured variables are sufficiently normally distributed with skewness and kurtosis coefficients within the -0.069 to -0.976 and 0.227 to -1.014 ranges respectively.Cronbach alpha values were also calculated for the measurement scales and all exceed the recommended 0.70 level indicating sufficient reliability (Garver and Mentzer, 1999). The theorized model is assessed following a structural equation modeling methodology. The traditional path analysis

methodology based on regression analysis described by Kline (1998) is also considered as an appropriate model development and testing methodology. Although the sample size is not large, Hair et al. (2006) argue that sample sizes from 150 to 400 are generally suitable for structural equation modeling analysis with sample size varying according to the complexity of the model and the number of parameters to be estimated.

Table I Construct definitions and variable names

Construct	Definition
Cost savings and competitiveness (COSCOM)	Cost savings and increase in business competitiveness due to the green supply management.
Corporate social responsibility and corporate image (CSRCIM)	Corporate social responsibility and public image of the organization in relation to its environmental management.
Policy and implementation (POLIMP)	Level of commitment the environmental policy and its implementation in the organization's supply chain.
Purchasing decision (PURDEC)	Purchasing criteria and practice under the environmental policy
Supplier cooperation and relationship (SCOREL)	Cooperation and relationship with suppliers to promote environmental protection.
Support and participation (SUPART)	Level of the management support and employee participation in the environmental policy and activities.
Supplier selection (SSELEC)	Selection of suppliers under the environmental policy.

Results

The Lisrel 8.72 software was used to analyze themodel as it is customary for theoretical model testing. Hair et al. (2006)recommend the use of one absolute fit index, one incremental, and the chi-squaredresult as measures for the overall fit of the measurement model. Figure 1 displays the final model with the structural equationmodeling results given in the LISREL 8.72 output. The final model includes only the paths which have significant regression coefficients. The standardized coefficients for the effects of various constructs are also presented in Table IV. Almost all of the coefficients are significant at $p< 0.01$ level. The resultsrelating to fit of the model generally support a claim of goodfit. The chi-square is 403.38 ($p= 0.687$) with 418 degrees of freedom thus producing the relative chi-square (chi-square/degrees of freedom)value of 0.97 which is less than the 3.00 maximum recommended byKline (1998). The root mean square error ofapproximation (RMSEA) is 0.00 which is below the recommended maximumof 0.08 (Schumacker and Lomax, 2004). While the goodness of fit index (GFI) of0.85 is below the 0.90 level recommended by Byrne (1998),it is more heavily impacted by a small sample size and, asByrne (1998) points out. The comparative fit Index (CFI)and incremental fit Index (IFI) are more appropriate whenthe sample size is small. The CFI (1.00) and IFI (1.00) bothexceed the recommended 0.90 level (Byrne, 1998). Another commonly used indicator is the standardized root mean square residual (SRMR) of 0.047 is below 0.05 the recommended maximum.

The results from the LISREL output are also used to evaluate other measures with the following tests:

Reliability – high inter-item correlation (Cronbach alpha in Table III); all above 0.70.

Convergent validity – items converge to measure one factor rather than many
(single dimension with adequate loadings; most above 0.60 except two in Table II)

Discriminant validity – the items form a factor that is different from othervariables in the model(average variance extracted for all constructs are above ornear 0.5in Table III).

Predictive validity – variables can predict dependent variables or be predicted byindependent variables (all constructs show expected statistical significance ($p< 0.01$ except two with $p< 0.05$) and adequate size of coefficients in Table III).

Table II Constructs and measurement scales with Cronbach alpha, descriptive statistics, and standardized loading

Construct/measurement variables	Alpha	Mean	SD	Loading
POLIM	0.919			
P1 Have a clear environmental management policy		3.88	1.219	0.77
P2 Rigorous environmental management practice		3.74	1.198	0.77
P3 Apply 3R(Reduce Reuse Recycle) policy in processes		3.70	1.137	0.63
P8 Strict compliance to law and regulations		3.70	1.075	0.79
P9 Have qualified and knowledgeable EM staff		3.46	1.106	0.78
SUPART	0.915			
P5 Have training and promote understanding at all levels		3.58	1.066	0.71
P6 Continuous internal and external communication		3.37	1.099	0.73
P7 Management supports in EM activities		3.62	1.094	0.79
P10 Employees aware about environmental impacts		3.42	0.953	0.77
P12 Continuous management interests and supports		3.45	1.087	0.78
CSRCIM	0.884			
B1 Avoid violating environment laws and regulations		3.62	1.183	0.64
B2 Feeling proud in company's role and personal contribution		3.43	1.080	0.77
B10 Build good community relationship		3.59	1.139	0.75
B13 Build employee cooperation through EM activities		3.48	1.172	0.77
PURDEC	0.882			
S1 Specify standards for environmental impacts		3.16	1.066	0.80
S2 Prohibit toxic or dangerous materials		3.52	1.206	0.73
S3 Specify appropriate product labels		3.77	1.193	0.51
S4 Require supplier's information on EM		3.18	1.139	0.46
SSELEC	0.875			
S4 Require supplier's information on EM		3.18	1.139	0.29
S5 Select suppliers with ISO 14001 certification		3.30	1.261	0.79
S6 Evaluate supplier's environmental management		3.08	1.177	0.85
SCOREL	0.944			
S7 Cooperation with supplier in product R&D for environment		2.78	1.150	0.75
S8 Exchange and suggest new ideas on EM		3.03	1.153	0.77
S10 Work with suppliers in developing community environment		2.82	1.169	0.76
S12 Cooperate in doing product life cycle analysis		2.85	1.207	0.82
S13 Promote development of EMS and activities by suppliers		2.83	1.229	0.83
COSCOM	0.940			
B5 Cost reduction and increase productivity		3.68	1.054	0.60
B6 Reduce legal claims and compensations		3.60	1.089	0.78
B8 Reduce barriers to export		3.55	1.205	0.79
B9 Reduce customer's pressure to comply with standards		3.59	1.121	0.80
B11 Increase competitiveness		3.78	1.138	0.85
B12 Create good images for company and products		3.92	1.069	0.81

Table III Results with standardized coefficients, DE=Direct effect, IE=Indirect effect, TE=Totaleffect

Latent variables	R^2	Effects	POLIMP	SUPART	CSRCIM	PURDEC	SSELEC
SUPART	0.88	DE IE TE	0.94 - 0.94				
CSRCIM	0,56	DE IE TE	- 0.70 0.70	0.75 - 0.75			
PURDEC	0.76	DE IE TE	0.67 0.18 0.85	- 0.20 0.20	0.26 - 0.26		
SSELEC	0.63	DE IE TE	0.67 - 0.67	- 0.16 0.16	- 0.21 0.21	0.79 - 0.79	
SCOREL	0.74	DE IE TE	- 0.71 0.71	0.35 0.09 0.44	- 0.12 0.12	- 0.45 0.45	0.56 - 0.56
COSCOM	0.32	DE IE TE	- 0.68 0.68	- 0.16 0.16	- 0.21 0.21	0.80 - 0.80	

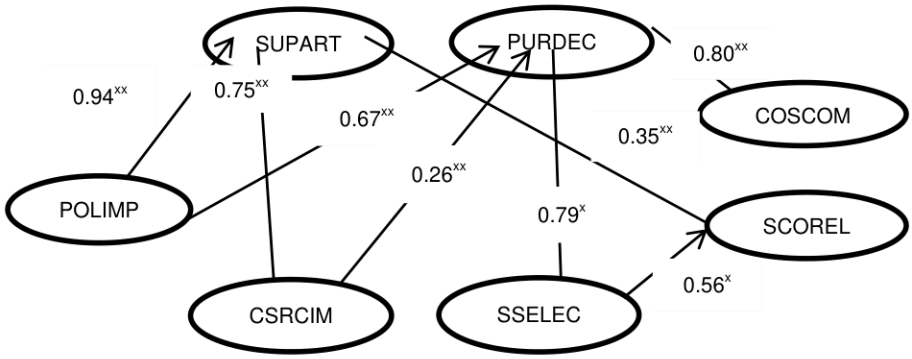

Figure 1. Structural equation model results: Standardized coefficients are significant at $^{x}p< 0.05$; $^{xx}p< 0.01$.

Discussion and Implications

The main aim of this studyis to determine the relationship between green supply management and business competitiveness. Drawing from the literature reviewthere has been very limited study for its confirmation especially with empirical data. The proposed structural equation model is an attempt to develop a causal relationship with theoretical support giving some useful recommendations to practitioners in green supply management. The model shown in Figure 1 has passed the goodness-of-fit tests and results can be used to support the acceptance of all the hypotheses.

H1a is accepted which posits thatfirms with strong commitment to environmental policy and implementation tend to have higher level of management support and employee participation in environmental management.Figure 1 and Table III also indicate interesting strong relationships between POLIM and CSRCIM. High level of management support and employee participation depends on strong commitment on environmental policy and implementation with the direct effect coefficient of 0.94. In turn high level of management support and employee participation in environment activities leads to higher level of corporate social responsibility and maintaining high corporate image (the direct effect coefficient of 0.75).

H1b is accepted whichposits that firms with strong commitment to environmental policy and implementation tend to have higher practice of green purchasing. The direct effect of POLIMP on PURDEC is displayed in Figure 1 with the standardized regression coefficient of 0.67. In addition, through indirect influence the total effect of the relationship is 0.85.
H2 is accepted which posit that firms with higher CSR and conscious about corporate image tend to have higher practice of green purchasing. Figure 1 indicates that CSRCIM has a direct effect on green purchase decision with regression coefficient of 0.26. CSRCIM is also a mediating variable of the impacts from the firm commitment to environmental policy and implementation.
H3 is accepted which posits that a firm's level of management support and employee participation in the environmental management is positively related to the level of green cooperation and relationship with its suppliers. From the results it is found that management support and employee participation in environmental management has a total impact coefficient of 0.44 on the level of supplier cooperation and relationship in environmental activities.
H4 is accepted which posit thatgreen purchasing decision is positively related to better cost and competitiveness. Results show that green purchasing decision alone has direct effect with regression coefficient of 0.80 on firms' cost and competitiveness. Table III also shows that cost and competitiveness of firms also indirectly influenced by other important variables such as POLIM (0.68), SUPART (0.16), and CSRCIM(0.21)

Conclusion

In this study a causal relationship model is proposed to explain the effect of environmentally concerned supply management on the overall cost reduction and business competitiveness. Although increasing number of research on green supply chain management is being conducted globally. Most of the results are specific within a country and thus need to be reconfirmed if they will be developed into accepted theory. The reported results from analyzing data from companies in Thailand show a strong influence of the level of commitment to environment policy and implementation on business competitiveness. The effectis mediated through management support and employee participation in the green initiative, corporate social responsibility and corporate image and green purchasing decision. Therefore, it is a strategic imperative that business organizations should incorporate environmental sustainability in its mission. It is also necessary to provide management support and promote employee participation in the environmental programs which include green CSR. The results also suggest business organizations to incorporate green criteria in supplier selection and promote collaboration and supplier relationship through environmental sustainable practices.

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