The Impact of the Greening of the Supplier on Competitive Advantage: Does Green Innovation Matter in Thai Auto Industry?

Sudawan Somjai[#1], Saroge Vasuvanich[*2], Khomsan Laosillapacharoen[*3], Kittisak Jermsittiparsert [4*]

[#1,3]*Graduate School, Suan Sunandha Rajabhat University, Thailand*
[*2]*Thai Summit Harness (Public) Co., Ltd, Thailand*
[#4]*Social Research Institute, Chulalongkorn University, Thailand*
[1]sudawan.so@ssru.ac.th
[2]saroge_v@thaisummit-harness.co.th
[3]Khomsan.la@ssru.ac.th
Corresponding author: E-mail: kittisak.j@chula.ac.th

Abstract **-The main focus of the currents study is to examine the role of the greening of the supplier in achieving competitive advantages. In addition to that the study has examined the mediating role green innovation namely product innovation, process innovation, and the managerial innovation in the relationship between greening the supplier and the competitive advantage of firms in the plastic industry of Thailand. The study has used the SEM-PLS to analyses the data. Due to the number of reasons the current study is using Structural Equation Modelling (SEM). SEM assumes that variables assed without any errors and have equal capability of consideration with linear and multiple regression analysis. Although SEM is very effective for the estimation of instrument with many distinct equations of multiple regression and also involve in factor analysis and multiple regression. The results of current study show that with the encouragement of green suppliers lead towards internal green product, managerial innovation and process [1]. which will increase competitive advantage. So, this study suggest that companies should integrate their upstream and downstream suppliers for achievement of environmental goals and relive of pressure from buyers. In international market these organizations can create a lot of job opportunities as compare to their competitors. By practice organizations must dedicate considerable efforts for providing guidance, assistance and technical support to suppliers for the implementation of environmental management systems, and organizing the seminars related to environmental awareness and training sessions for helping suppliers for improvement of firm.**

Keywords: *Green Supply Chain, green innovation, Thailand*

1. Background

Companies around the world are focusing on the development of green products and Environmentally friendly projects, because of the pressure of environmental issues from government public and customers [32-33]. For example, eco-design, green technologies and green brands [2, 3]. The international buyers and customers are demanding the products without containing dangerous and poisonous ingredients from the suppliers. They are expecting from supplier for the reduction in consuming natural resources in production for the reduction of bad effects of production on environment. [4] suggested that cost saving, legislation and compliance with regulation are the key driving strength for the implementing environmental management (EM). [5] also stated that for attaining the operational and financial advantages companies have to make sure the implementation of Green Supply Chain Management (GSCM) practices. For innovation process of green technologies (GT) and green products can be faster with the help of Well-designed environmental standards. [6] argued that with the process PRDIN (PPI)companies can lower the cost of production, improve the quality of product and make differentiation in their products. For the consideration of their packaging design they can environmental concept. According to the [6] to overcome the pressure of regulations competitors and customers the important solution is Continuous innovation. So, within the organization for implementing GSCM practices and adoption of Green innovation (GI) is most important [7].

[8] made a research GSCM practices and their association between economic performance and competitiveness. The results of their research show that with the implementation of GSCM company can improve economic performance and its competitiveness. This is consistent with previous study which have suggested that with taking the initiatives related to environmental issues the cost of production of organizations may reduce further and economic effectiveness can be improved as well [9]. Competitiveness may improve by the improvement in compliance with environmental regulations and corporate environmental performance (EP) [6, 10-12]. We may divide the GIin three main groups: green MNIN; green PRCSIN and green PRDIN [13]. a [13] suggested that corporate competitive advantage is positive related with green manufacturing PRCSINs and green product. [14] presented the concept of core competencies concept as

well. According to him "The abilities of collective learning regarding environmental management and GI are known as green core competencies". Green core competencies (GCC) have positive effect on PRCSIN and on ability of a firm for developing the green product. Thailand's automotive industry is one of the fastest growing in region as evident from the figure 1

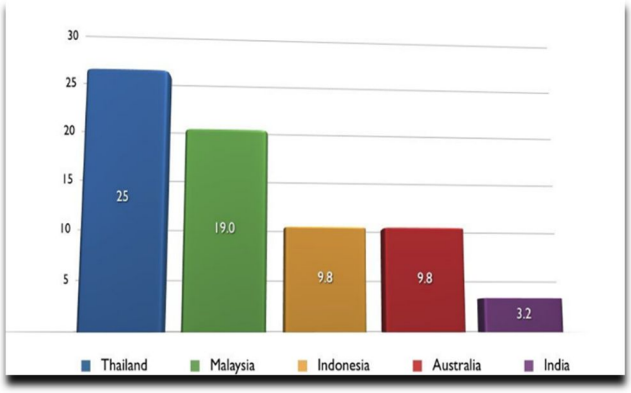

Figure 1. Thailand Automobile production (per capital*1000) Comparison
Source: industry data

In return this helps in improvement of competitive advantage and green image of company. These studies didn't explore the effect of GI particularly on EP and the effect of green supply chain (GSC) on supply chain on GI. Though a lot of research is made on the GSCM, but, relatively little research attention has been focused on Thai industry. [13] and [14] are the only studies available on GI who focused on Thailand. In the past few decades the economy of Thailand has extremely grown but with the bad impact on natural environment. These companies are also the big partners of world leading IT organizations therefore playing an important role in international markets as well. Thailand is the main global producer of IT products internationally. So, we cannot underestimate the consumption or resources of Thailand industry.

The focus of current study will be on Thailand because relatively less research been made in this area. The previous studies didn't consider the association between GI and greener supply chain (greening the supplier), on capabilities of developing manufacturing processes of green products and managerial innovation (MNIN) they just measure the relationship between competitive advantage or performance and GSCM. In current study we will measure these relationships and their effect on organizations competitive advantage and EP. The contribution of this study in theoretical research is considering the interaction association among all those factors which were not been considered in literature.

2. Literature Review

In traditional SCM GSCM plays an important role [15]. Few years back just with the implementation of SCM like by making improvement in source decisions a company can get competitive advantage [16]. But now due to customers pressure of environmental concerns companies are required to make their supply chains environment friendly Additionally, with the implementation of environmental management system properly and by addressing environmental issues companies can get more business opportunities as compare to their competitors [17]. According to the [18] there are many definitions of GSCM, we can classify GSCM into external and internal environmental management. Focus of internal environmental management acquiescence with certification, presence of environmental management systems in organization, support and commitment for GSCM, whereas the external is linked with green suppliers because for the achievement of environmental objectives they are involve in organizations [5, 10, 19]. It also included in cooperate with customers, investment recovery, green purchasing, eco-design practices and environmental requirements [13]. As per literature some studies found that integrated suppliers are stronger in process of product innovation (PRDIN) and can be helpful increasing the overall performance of firms [20, 21]. However, some conflicted evidences are also there which states that these types of integrations can reduce the performance [22]. Before making a debate on environmental practices it very important to know the effects and association between integrated practices of GSCM. And in greening the suppliers who are using the green innovations process can know easily the effect and association on competitive advantage and EP.

In organizations due to the customers environmental concerns and strict govt regulations environmental issues are more strategic issues now. Closely working with suppliers may develop long-term strategic advantages as a result. Quality and suitable level of products and services may achieve with proper appraisal system in partnership. The companies involved in establishment of close supplier relationship have important changes in their attitudes, for both parties it requires the investment of resources and time [23].

For providing advice and assistance, enough guidance sharing their skills and knowledge with suppliers and help them for becoming green, companies need to work with them closely. Numerous large companies working towards for their suppliers this have establish own environmental standards. Green innovation is frequently divided into green PRCSIN and green product [13, 14]. For instance, [24] have divided green innovation into manufacturing process aspect and product design aspect. Aspect of product design green innovation is included in the modification of design in existing product for the reduction of its bad effects on environment in different stages in life cycle of product. In the process aspect in

green innovation the adoption of any manufacturing process which decreases the bad effect on environment throughout the delivery, production and purchase of material. We can never underestimate green MNIN (GMI)by implementing GSCM practices.

For the effective implementation of innovation, support of senior management is most important. [25] made a research on manufacturing industry of china and stated that the commitment of middle level or top managers have important effect on the successful implementation of internal environmental management. So, in current study we have defined green innovation including green process innovation (PRCSIN), green PRDIN and green PRDIN. Customers and buyers are more concerned about environmental issues, so they demand from suppliers for the products which are environment friendly. So, it's important in process of product development with supplies work closely to use such materials in packaging which does not have bad effect on environment. For improving product designs and improvement in overall manufacturing process it is useful to involve supplier. [10] stated initiatives for greening the supplier leads to green innovations and greener suppliers. But other studies found that these types of integration may reduce the performance for instance increase in development cost and time. Some studies have proved that for the successful implementation of environmental management practices, green initiatives support of internal management is most important. We Have purposed our first hypothesis for determining that there is a positive association green innovation and greening the supplier. The current study will just focus on PRCSIN and green innovation. In this study for understanding the effect of greening the supplier we divide green innovation in three parts green MNIN, green PRCSIN and green PRDIN. Organizations may get the market information from suppliers so working closely with them may increase competitiveness. For instance, with the implementation of partnering system companies of Taiwan in international market have decreased their cost of production, made improvements in the quality of product and increase competitiveness.

H1: The CRTS has an impact on the COMPAD

H2: The PRDIN has an impact on the COMPAD

H3: The PRCSIN has an impact on the COMPAD.

H4: The MNIN has an impact on the COMPAD

H5: The CRTS has an impact on the PRDIN

H6: The CRTS has an impact on the PRCSIN

H7: The CRTS has an impact on the MNIN

H8: the PRDIN mediates between greening the supplier and the COMPAD

H9: the PRCSIN mediates between greening the supplier and the COMPAD

H10: the MNIN mediates between greening the supplier and the COMPAD

3. Methodology

In current study we have employ inferential and descriptive statistics for analyzing the data, for data analysis we have adopted Partial Least Squares Structural Equation Modeling (PLS-SEM). After collection of raw data and coded the questionnaires for using to Statistical Package for the Social Sciences (SPSS v18). So, for analyzing the data we have adopted this method. At first for finding the errors in data experienced screening, for the identification and correction of missing values using their respective mean values for all variables we have run the frequency test. Then we have used the descriptive statistics for comparing and describing the demographics. At the end we have adopted the second-generation SEM which is PLS-SEM. SEM plays an important role for the investigation of impacts and associations between the latent constructs [26]. In general, for multivariate modelling complex PLS-SEM is path modelling statistical method and for multivariate analysis of association between latent and observed variables. For testing of purposed theory and statistically building the model PLS-SEM approach is flexible, superior and strong tool [27]. [28] stated that with the use of PLS-SEM path modelling confirmatory factor analysis reliability and validity can be done in a better way.

Due to the number of reasons the current study is using Structural Equation Modelling (SEM). SEM assumes that variables assed without any errors and have equal capability of consideration with linear and multiple regression analysis. Although SEM is very effective for the estimation of instrument with many distinct equations of multiple regression and also involve in factor analysis and multiple regression. For collecting sample, we have employed the cluster sampling technique. [29], have presented the Five-technique approach is used for calculating sample size in current study. First step is estimation of total population, [30] have presented the table for estimating the sample size of population. The total population size is 310. SEM is commonly used and most powerful measure in social sciences because it can test many associations at a time.

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SEM is most suitable methodology due to many reasons like its best between the present techniques it is more advance and provide vigorous solution for the problems of researchers which may not be achieved by using multiple regression. [26] stated that for obtaining explanation and forecasting the constructs PLS approach is very helpful. For this study we have used PLS-SEM technique pretend to flexible, in terms of sample size demand less and due to its capability of handling multiple structural modeling. Furthermore, model is established for formation and reflecting the constructs. The purpose of current study is to intimate and forecast between constructs. Hair, Hult [31] also supported this reason of using Partial Least Square approach. It involved in two models that is measurement model and structural model.

4. Results

Valuation of inner model and valuation of outer model are the two steps of SEM, and the outer model valuation is identified as measurement model and finally known as structural model. The measurement model follows the different criteria like in structural models' variance and validity, reliability. By nature, items are dynamic therefor a robust correlation is predictable between variables which are combined to forming a construct. For measurement model the confirming the validation like how variables are experimented the current study has used the confirmatory factor analysis. All the variables analyzed distinctly by using formative reflective and structural modeling for estimating the measurement model throughout.

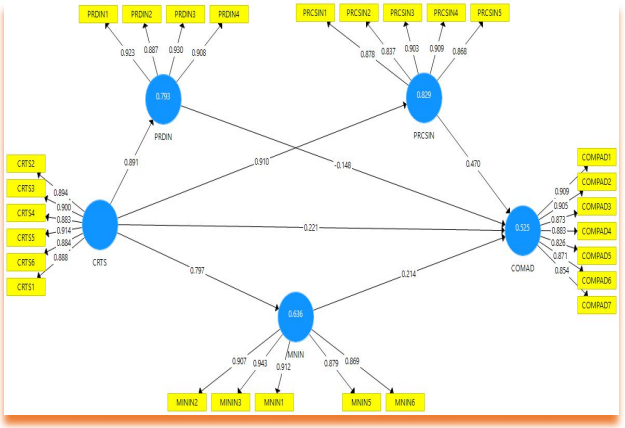

Figure 2. Measurement Model

To start with internal reliability typically measure the reliability of findings in the same test items. It checks either projected items measured the constructs are providing same scores [31]. So, in the current study internal reliability is evaluated with examine [26], stated that differently with Cronbach's alpha CR isn't except for loading of construct as equal indicator. The value of CR contrasts between 0-1: the minimum value should be more than 0.60, and the values 0.70 and greater are desirable [31]. Therefore, value of CR between 0.6- 0.7 shows average internal reliability, whereas the value between 0.70 and 0.90 is observed as more satisfactory. Convergent validity is the next one which state at wot extent measurement of any construct which is theoretically associated with each other. Henceforth, between the measures of same constructs it shows the degree of correlation. Value of AVE is used with minimum of 0.50 and above in the measurement of construct regarding to identify converging elements. If the value of AVE is 0.50 it indicates satisfactory convergent validity. In other words, half of variance of its indicators is explained by the latent constructs and shows satisfactory convergent validity [26].

Table 1. Reliability

	Alpha	rho_A	CR	AVE
COMPAD	**0.949**	**0.949**	**0.958**	**0.765**
CRTS	**0.950**	**0.950**	**0.960**	**0.799**
MNIN	**0.943**	**0.946**	**0.956**	**0.814**
PRCSIN	**0.926**	**0.928**	**0.944**	**0.773**
PRDIN	**0.933**	**0.934**	**0.952**	**0.832**

Formerly, discriminant validity is considered as the extent at which one construct is change from another and in other words the measurement of construct which are distinct from each other. The assessment of discriminant validity is the most conventional approach [26]. Others comprises method of cross-loading inspection. Which considered to be more generous. Meanwhile it has more constructs for show discriminant validity.

Table 2. Validity matrix

	COMPAD	CRTS	MNIN	PRCSIN	PRDIN
COMPAD	0.875				
CRTS	0.787	0.894			
MNIN	0.743	0.797	0.902		
PRCSIN	0.704	0.710	0.787	0.879	
PRDIN	0.743	0.791	0.784	0.708	0.912

The predicted value of reliability index is more than or equal to 0.70. in current study the evicted values of cross-loading and outer-loading are same. Whereas the presence of correlation between variable constructs is analyzed by cross loading. So, this study will observe the discriminant validity among variables and in their constructs as per below table3:

Table 3. Outer loadings

	COMPAD	CRTS	MNIN	PRCSIN	PRDIN
COMPAD1	0.909				
COMPAD2	0.905				
COMPAD3	0.873				
COMPAD4	0.883				
COMPAD5	0.826				
COMPAD6	0.871				
COMPAD7	0.854				
CRTS2		0.894			
CRTS3		0.900			
CRTS4		0.883			
CRTS5		0.914			
CRTS6		0.884			
MININ2			0.907		
MININ3			0.943		
MNIN1			0.912		
MNIN5			0.879		
MNIN6			0.869		
PRCSIN1				0.878	
PRCSIN2				0.837	
PRCSIN3				0.903	
PRCSIN4				0.909	
PRCSIN5				0.868	
PRDIN1					0.923
PRDIN2					0.887
PRDIN3					0.930
PRDIN4					0.908
CRTS1		0.888			

Assessment of measurement model included valuation of validity and reliability after that valuation this study will valuate structural model with assessment of structural paths among moderating, dependent and independent variables. SEM-PLS is different from the other techniques. PLS-SEM method detects valuation of all he constructed variables at the same time. So, it analyzes the indirect and direct impacts of variables in structural model.

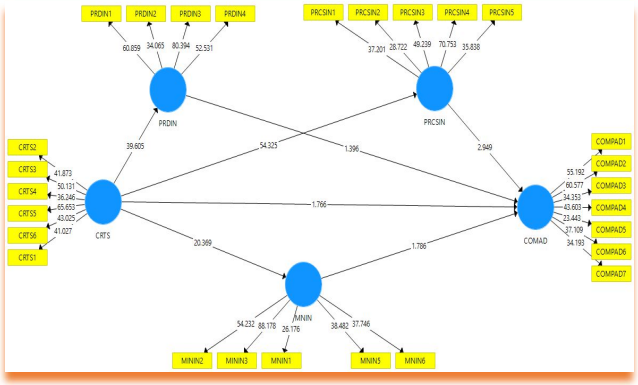

Figure 3. Structural Model

The examination of inner model starts with association of dependent and independent variables. PLS-SEM procedure valuates the size of path coefficients, through PLS-SEM bootstrapping process importance and association is evaluated in Smart PLS 3.0. We have use sample of 5000 cases as bootstrapping samples [26]. First model focus on the te direct association between dependent and independent variables. And in second model we introduced a mediator and explain the association among dependent variable, independent variable and mediator.

Table 4. Direct relationships

	(O)	(M)	(STDEV)	T Statistics	P Values
CRTS -> COMPAD	0.687	0.689	0.070	9.855	**0.000**
CRTS -> MNIN	0.797	0.799	0.039	20.369	**0.000**
CRTS -> PRCSIN	0.910	0.911	0.017	54.325	**0.000**
CRTS -> PRDIN	0.891	0.891	0.022	39.605	**0.000**
MNIN -> COMPAD	0.214	0.210	0.120	1.786	**0.037**
PRCSIN -> COMPAD	0.470	0.465	0.159	2.949	**0.002**
PRDIN -> COMPAD	0.148	0.137	0.106	1.396	**0.081**

Table 5. Mediation

	(O)	(M)	(STDEV)	T Statistics	P Values
CRTS -> MNIN -> COMPAD	0.171	0.167	0.095	1.804	**0.036**
CRTS -> PRCSIN -> COMPAD	0.427	0.423	0.145	2.939	**0.002**
CRTS -> PRDIN -> COMPAD	0.132	0.122	0.095	1.391	**0.082**

The coefficient of determination that is R^2 explain expected power of endogenous variables in structural modelling. The value of path coefficient which is close to 0 show the insignificance of coefficients. the value of R^2 is between 0-1 if the value is close to 1 its shows high expected accuracy and so on. If the value is 0.75 it shows enough expected power and 0.50 shows moderated expected power and if the value is 0.2.

Table 6. R-Square

	R Square
COMPAD	0.525
MNIN	0.636
PRCSIN	0.829
PRDIN	0.793

The ability of model's expected significance is another measurement of structural model. By using the Stone–Geisser criterion expected significance can be measured which undertakes the evidences of expected endogenous latent construct's indicators should be provided by the inner model. Henceforth, by using Stone-Geisser's Q2 test

expected significance can be done which may be measure using blindfolding procedure.

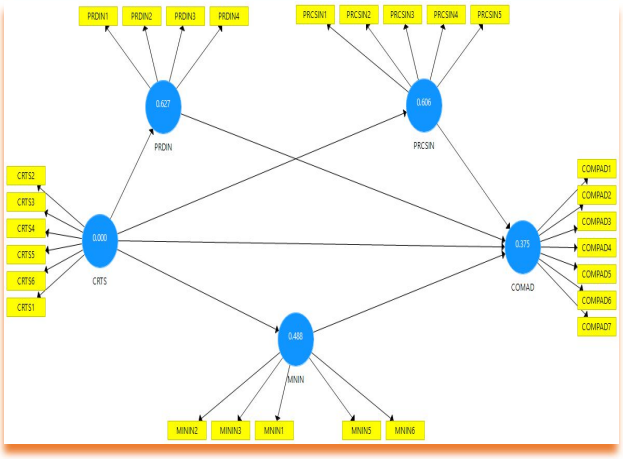

Figure 4. Q-square

So, in this study we have used Stone-Geisser test to measure Q2 with blindfolding process for obtaining cross-validated redundancy measurement of endogenous latent construct

Figure 4. Q-Square

	SSO	SSE	Q^2
COMPAD	1,519.000	949.309	0.375
CRTS	1,302.000	1,302.000	
MNIN	1,085.000	555.265	0.488
PRCSIN	1,085.000	427.440	0.606
PRDIN	868.000	323.587	0.627

5. Conclusion

In future Innovation and environmental management are forecasted as the main performance indicators of a firm for competitive advantage. Though green MNIN cannot improve the environmental performance with the focus on green MNIN, cost saving of the firm, green product and PRCSIN, increase in productivity and efficiency and good quality of product all leads to improve competitive advantage. And for the enhancement of green reputation of firm number of opportunities are there for entering in new markets with green PRDIN. The main benefit of using green innovation is the barrios of entering competitors will increase. Furthermore, with the reduction in pollution poisonous waste green efficiency can be improved, reduction in disposal cost for dangerous waste improves the acquiescence and regulations and improvement in response to customers environmental pressure and will increase competitive advantage internationally with best quality of product. So, implementation of environmental management must be there in organizations and with the integration of green innovation in business for building and maintain competitive advantage. Though better environmental performance may not achieve with green MNIN. So, the focus of top management should be mainly on PRCSINs and green product, because of strong link among these and environmental performance.

The results of current study show that with the encouragement of green suppliers lead towards internal green product, MNIN and process [1]. which will increase competitive advantage. So, this study suggest that companies should integrate their upstream and downstream suppliers for achievement of environmental goals and relive of pressure from buyers. In international market these organizations can create a lot of job opportunities as compare to their competitors. By practice organizations must dedicate considerable efforts for providing guidance, assistance and technical support to suppliers for the implementation of environmental management systems, and organizing the seminars related to environmental awareness and training sessions for helping suppliers for improvement of firm. This will increase productivity and environmental performance of supplier and enhance competitive advantage as well, which will be a win-win situation for both.

Through implementation environmental management systems involved capital expenditure which I future is most profitable investment. Organizations must invest in GSCM, and particularly in green innovation and greening of supplier and fulfilment of tight environmental regulations. And internationally building and maintaining of competitive advantage. The summary of current study is the green innovation and greening of the supplier is related with firms' competitive advantage and environmental performance. So, companies must dedicate considerable efforts for addressing environmental issues side by side with supply chains for survival and maintaining competitive advantage. Future research can be done by taking large scale survey among the different developed and undeveloped countries with different maturity stages. The key focus of this survey is on the relationship among subsequent competitive performance, green innovation and greening the supplier. Future research can take other practices of GSCM and can explore in detail about moderation impact of green MNIN on PRCSINs and green product.

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