

## Critical Factors Effecting Supplier Participation in Green Supply Chain A Case study of Thai Auto Parts Manufacturing

ปัจจัยสำคัญที่ส่งผลกระทบต่อการมีส่วนร่วมของผู้ส่งมอบในห่วงโซ่อุปทานที่เป็นมิตร  
ต่อสิ่งแวดล้อมกรณีศึกษาผู้ผลิตชิ้นส่วนรถยนต์ในประเทศไทย

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### Abstract

Due to the increased awareness of environmental issues on sustainable development in supply chain, green supply chain management has become an important concern for manufacturers. The objective of this research is to identify the critical factors for supplier participation in green supply chain. Three potential factors of supplier participation in green supply chain were proposed in research framework: environmental regulations, customer pressures, supplier's management and organization. The research used survey data obtained on auto parts manufacturers in Thailand and testing the relationships with Structural Equation Modeling. The results revealed that all three factors have positive impact to supplier participation in green supply chain. The contribution of this study is to provide guidelines for auto part manufacturers and government to place strong emphasis on the critical factors of green participation and motivate their supply chain members to realize the importance of environmental protection and achieve the sustainable supply chain performance.

**Keywords:** Green logistics and supply chain, Sustainable logistics and supply chain management

### 1. Introduction

Over the past several years, business organizations in South East Asia have recognized the concept of “greening”. Rao (2005) stated the important reasons for greening of suppliers such as the global companies include suppliers into consideration of company's environmental performance in order to promote the corporate social responsibility. Also, South Asia has increased the importance as a hub to the global manufacturers. In addition,

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companies realized that customers and stakeholders do not distinguish between company's environmental performance and their suppliers.

Thailand is currently the vital producer for Asian's automotive parts industry. The awareness of environmental issues on sustainable development in supply chain is also increasing. Thus, there is a great concern among car manufacturers in Thailand about green supply chain management. Environment performance has been instituted in auto parts manufacturers in Thailand. Japanese car manufacturers focus on how to improve the environmental performance includes pollution control initiatives, using of friendly environment materials and partnership with the green organization (Lin et al, 2011). Companies rely on suppliers to increase their supply chain performance. Also, suppliers can create a competitive advantage by being proactive in green supply management (Handfield et al, 2002). Therefore, supplier plays critical roles to improve environmental performance in the supply chain.

However, many auto parts manufacturers still lack of quality production system that caused of environmental pollution and high energy consumption. In addition, most of auto parts manufacturers in Thailand are small and medium enterprises. Although SMEs is a large part of manufacturing, they lack of motivations for participation in green supply chain practices. While green supply chain management has become a more widely discussed in recent years, few papers study the key factors of supplier participation in the green supply chain in the context of Thai auto parts manufacturing.

This study focuses on critical factors effecting supplier participation in green supply chain. This will help companies to realize the importance of greening suppliers and to understand the factors driving suppliers to make the manufacturing process more environmental friendly.

## 2. Literature review

Previous literatures in supply chain management study the factors effect to green supply chain management (Ageron et al 2012; Giunipero et al, 2012; Rao 2005; Hsu et al, 2013; Caniels et al, 2013). Several factors are specified in research studies such as government regulations, customer requirements, supplier readiness, market competitors and top's management attitude. In addition, a high level of supplier environmental management is related to a high level of supplier performance in green supply chain (Caniels et al, 2013). Large and Thomsen (2011) examined the relationship between the environmental commitment of the firm and implementation of the green supplier assessment approach. The

result of study revealed the positive relationship between two constructs. Therefore, supplier is the key person to motivate the green supply chain

This study proposed 3 green factors effect to supplier participation in green supply chain as environmental regulations, customer pressures, supplier's management and organization

## **2.1 Environmental Regulations**

Government rules and regulations play an important role to drive corporate doing business complying with environmental legislation (Giunipero et al, 2012 and Preuss, 2002). The result of Delphi study of Giunipero (2012) shown that compliance to government regulations was critical factor to support sustainable supply management. This consistent with the result of Hsu and Tan work (2013), regulatory measures was found to be the significant drivers to green initiatives. In addition, Rhmanand Shrivastava (2011) specified that environment regulation and policies are motivating the organizations to be more environmental friendly producers. Furthermore, Ageron et al, 2012 demonstrated that government regulatory requirements are significant motivations for sustainable supply management. This consistent with Zhu et al (2007), they mentioned that government regulation was one of the key drivers to drive organizations adopting environmental practices. According to Laosirihongthong et al (2013), found that legislation and regulation is a key driver in green supply chain practices. It is also found that Thai manufacturers have a positive relationship with three dimensions of performance include environmental performance, economic performance and intangible performance. Moreover, the result of Lee (2008) work found that government involvement has a positive influence on the willingness of SMEs suppliers to participate in green supply chain initiatives. Therefore, environmental regulations are consideration as a key critical factor associated with the supplier participation in green supply chain. Based on the result of previous studies, this study hypothesises that:

## **2.2 Customer Pressures**

Several studies suggested that customer pressure is the key driver in adopting green practices. Customer pressure is one of the most important factors that encourage buying firm to greening their suppliers (Rao, 2007). According to Ageron et al (2012), customer demand plays a major role influenced company to adopt the sustainable supply management. Also, more customers are aware of buying green products. Companies were trying to differentiate themselves as unique among consumers in order to gain the competitive advantage

(Jaggernath , 2015). Heras- Saizarbitoria et al (2011) noted that customer pressure as a main driver of the adoption of ISO14001. It is necessary to ensure that products comply with consumer requirement, companies need to establish the environmental standards involving quality improvement (Hu and Hsu, 2010). In addition, buyers and end-user product manufacturers are the most priority influence for the supplier to improve the environmental performance (Lee, 2008). According to Caniels et al (2013) revealed that customer requirements with respect to green manufacturing is positive impact to supplier participation in green initiatives. In addition, the result of Delphi study of Giunipero et al (2012), suggested that customer requirement as an important factor driving green efforts by suppliers. It is also indicated that supplier performance in green solutions often specified in customer's contract. This consistent with Gualandris and Kalchschmid (2014), they found that customer pressure represents an important driver for the development of sustainable supply management via sustainable process management. As the current trend, customers have increasing demand for eco-friendly products. Thus, buying companies as a major stakeholder has the power to influence their suppliers involving in environmental practices.

### **2.3 Supplier's Management and Organization**

Supplier's management and organization act as an internal driver on going green by firms (Lo, 2014). According to Giunipero et al (2012), found that top management initiatives was the most important driver of sustainability. It plays a key role as a leadership who encourage firm to adopt green practices. Furthermore, Holt and Ghobasian (2009) specified the internal factors of organizations that influence the environmental practices including top management attitude, employee's concern and organization culture. Also, Ageron et al (2012) stressed the importance of top management to support the green supply chain management. This consistent the study of Jaggernath (2015), they highlights the strong vision of partnerships in green supply chain. This study also suggested that the leading companies with strong vision in adopt green management leading to accomplish the green practices such as General Electric. These may lead to improvements in environmental outcomes. Furthermore, Hervani et al (2005) stressed that the internal sources of knowledge are important for firm's environment innovation. Therefore, companies with green initiatives often concern to the employee's knowledge in green practices. This also includes the technical skills and competence of purchasing personnel which effect to the green capabilities.

In addition, Ageron (2012), studied the barriers for sustainable supply management. They specified that financial cost and green investment are one of the major reasons for

companies to attend the sustainable supply management. However, this may be the important factor that effect to the supplier readiness in green supply chain management.

#### **2.4 Supplier participation in green supply chain**

Previous studies identified the supplier participation in green supply chain. This study divides the supplier participation in green supply chain into two groups: green activities and green organization and management. A number of literatures specified the green activities ranging from green purchasing, green design, green manufacturing, green transportation and green packaging. Green purchasing focuses on purchased items with ecological attribute such as reusability, recyclability and non-toxic materials including certifying suppliers, purchasing environmentally materials/products (Hu and Hsu, 2010; Hervani et al , 2005). Green design refers to the design for the environment to reduce the environmental impacts of products during their life cycle (Hsu et al, 2013). Zhu et al (2007) suggested that firms should include the green packaging ensuring that packaging is reusable and recyclable and minimizing waste by reducing packaging (Laosirihongthong et al, 2013; Carter and Carter, 1998; Walker et al, 2008). Lo (2013) suggested to avoid using the materials prohibited by legislation including carbon reduction and lead-free manufacturing process are consideration as Green manufacturing. Perotti et al (2012) specified a variety of activities for Green transportation such as use of alternative fuel, eco-friendly mode selection, more recent/less polluting vehicles, effective shipment consolidation and full vehicle loading Routing systems to minimize travel distances.

The second group is presented by green organization and management. Refer to Simpson et al (2007), they defined the environmental commitment as the willingness of an organization to determine, articulate and manage its responsibilities toward the natural environment. The prior works of researcher demonstrated that the higher level of environmental commitment provide positive effect to the organization's environmental performance (Simpson et al, 2007). Moreover, Environmental education and training are necessary for promoting the environmental awareness of companies and suppliers (Hu and Hsu, 2010). This consistent with the result of Del Brio and Junquera (2003) demonstrated that the lack of environmental training and orientation related to the firm's lower abilities to obtain innovations in green supply chain management. Thus, environmental training is needed when implementing green initiatives in the organizations. Hu and Hsu (2010) indicated that it is important to establish an environmental policy in order to increase the awareness of environmental issues to the organization. Also, management should communicate the green

policy throughout the organization to ensure that everyone understand the environmental goals of the company. Large and Thomsen (2011) found that the environmental commitment of the firm is positive related to the implementation of the green supplier assessment. This shown that the higher level of environmental commitment influences the higher level of greening the supplier. In addition, the result of this work suggested that the degree of green supplier assessment and the level of green collaboration direct influence on environmental performance. Therefore, management should consider the green performance by increased cooperation between firm and supplier to improve environmental performance. Also, managers should conduct monitoring and evaluating supplier performance to get the results for environmental improvement.

Based on the result of previous studies, this study identify green factors as drivers that motivate suppliers to engage in green supply chain including environmental regulations factor, customer pressures factor, supplier's management and organization factor.

Therefore, this study hypothesises that:

**H1: Green factors are positively related to supplier participation in green supply chain**

Based on the above assumption, the research framework is as shown in figure 1.

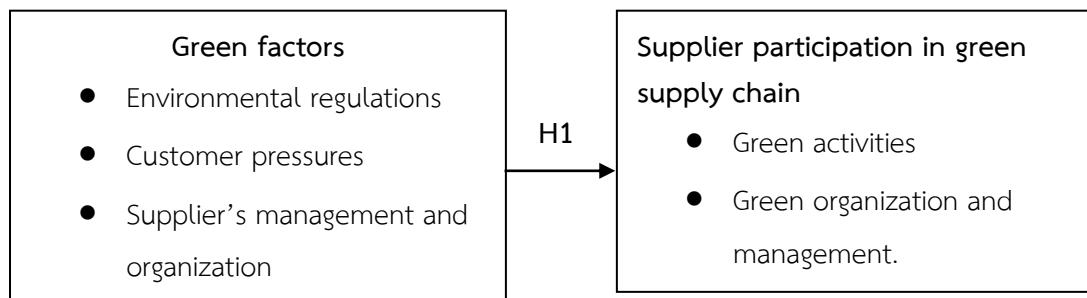


Figure 1. Research framework

### 3. Methodology

A survey instrument was developed to collect data for this study. To test all hypotheses, all data is collected through interview questionnaire surveys of Thai auto part manufacturers. A total of 500 questionnaire surveys were sent by mail and email with a hyperlink to the online questionnaire since July, 2014.

Finally, a reminder e-mail was sent to the non-respondents three weeks after the initial email and those who still failed to respond were contacted by telephone in August, 2014

SEM is a statistical methodology that takes a confirmatory method to test the causal relationship in structural equations. This study followed the two-step approach suggested by Anderson and Gerbing (1988). The first step is to verify the confirmatory factor analysis and the second step is to test the measurement model. If the first step satisfies the acceptable fit, the second step is applied. Confirmatory factor analysis (CFA) resulted in the elimination of several individual items because of low factor loadings or high residuals (Bryne, 2010). A factor loading is a measure of how much the variable contribute to common factor (Yong and Pearce, 2013). Therefore, high factor loading scores indicate that the high positive rotated the factors on a variable. In addition, confirmatory factor analysis (CFA) is used to test the relationships between individual questionnaire items and their respective latent factors.

Average variance extracted (AVE) is a way to assess the convergent validity. AVE can be calculated using standardized loadings. The rule of thumb suggests that an AVE of 0.5 or higher provides adequate convergence.

### 3. Results and discussion

Cronbach's coefficient alpha was used to access the scale reliability. The Cronbach's alpha values were all above the acceptable level of 0.7 as shown in Table I (Nunnally, 1978).

In addition, the composite reliability coefficient (CR) for environmental regulations, customer pressures, green activities and green organization and management were 0.761, 0.733, 0.819 and 0.902, 0.933 respectively, exceeding the threshold of 0.6 suggested by Bagozzi and Yi, (1988).

As shown in table II, most of the respondents were Thai companies (69.9%). Japan's investment was the highest among investors, followed by Taiwan, Korea, and US. The number of employees indicates the diversification of the organization ranging from small in size to large. Small and medium enterprises were mostly auto parts manufacturers in Thailand.

Most respondents came from the purchasing and supply department (45.2%) followed by 13 Administrative office (14.0%), 7 Logistics and SCM (7.5%) and 4 Production and 4 QC (8.6%) and others (14.7%) including, research and development, transportation and planning.

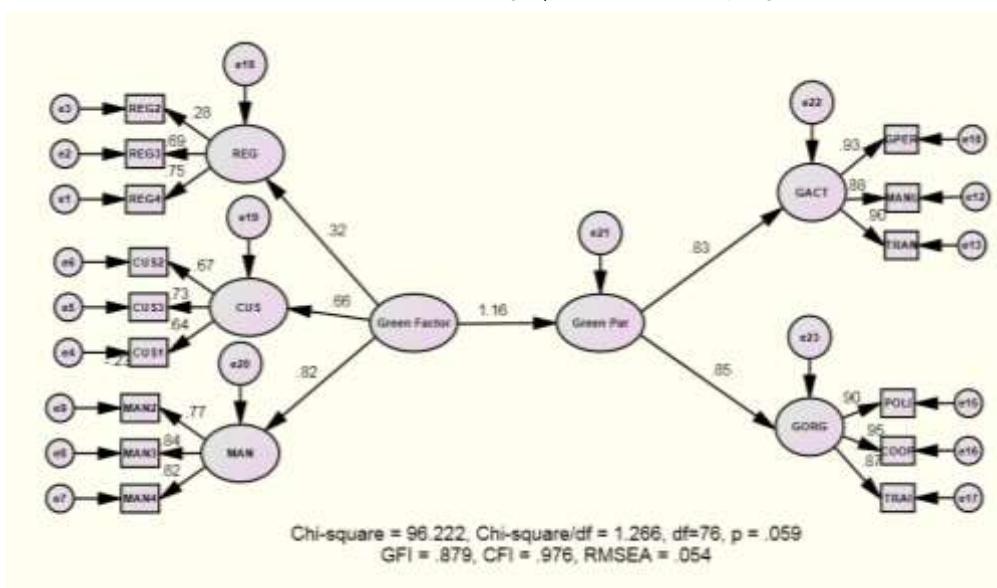
Item	Factors	Factor Loading	Cronbach's	AVE	CR
REG1*	Firm's parent company sets strict environmental standards to comply with	0.233	0.725	0.516	0.761
REG2	Trading partner of many countries set strict environmental standards	0.662			
REG3	Government environmental legislations	0.781			
REG4	International environmental standard requirements <u>ex</u> ISO	0.707			
REG5*	Financial incentives by government	0.637			
CUS1	Buying firm has the green policy to support doing business with green supplier	0.66	0.73	0.510	0.733
CUS2	Green criteria specified in purchasing contract	0.72			
CUS3	End customers are buying increasing numbers of environmentally friendly cars	0.692			
MAN1*	Supplier's readiness in green technology investment	0.639	0.81	0.605	0.819
MAN2	Top management attitude	0.91			
MAN3	Employee's environmental knowledge	0.672			
MAN4	Employee engagement	0.732			
MAN5*	Organization's culture	0.471			
GPER	Green purchasing	0.812	0.877	0.755	0.902
DESI*	Green design	0.704			
MANU	Green manufacturing	0.878			
TRAN	Green transportation	0.914			
PACK*	Green packaging	0.88			
COMM*	Management commitment to environmental protection	0.685	0.904	0.822	0.933
POLI	Communicate environmental policies to all sta	0.918			
COOP	Increased cooperation to improve environmental performance	0.916			
TRAI	Environmental training program	0.885			
MONI*	Monitoring and evaluating environmental performance	0.861			

\*some items were dropped during loading purification

Table I : Constructs and Factor Loadings

Ownership Type	Number	%
Thai	65	69.9
Joint-venture	18	19.4
Foreign investment	10	10.8
Authorized capital investment		
Below 50 million baht	51	54.8
51 – 200 million baht	26	28.0
More than 200 million baht	16	12.0
No. of employees (persons)		
Less than 200 workers	44	47.3
Between 200 - 500 workers	18	19.4
Between 501 - 1,000 workers	13	14.0
Between 1,000 - 1,500 workers	10	10.8
Between 1,500 - 2,000 workers	3	3.2
More than 2,000 workers	5	5.4

Table II : Demographic data of buying firms



is reasonable to conclude that the proposed model has good construct validity. The results of overall fit indices are reported as follows: Chi-square = 96.222, degree of freedom = 76, goodness of fit index (GFI) = 0.879, comparative fit index (CFI) = 0.976, root mean square error of approximation (RMSEA) = 0.054. It can be seen that all indicators reached the acceptable level. In support hypotheses H1, the path co-efficient of 1.16 is significant ( $p < 0.01$ ). Green factors are critical to encourage significant supplier participation in green supply chain. The findings suggest that supplier management and organization was found to be the most significant drivers in supplier participation in green supply chain (Loading = 0.82). This imply that top management attitude, employee engagement and employee's environmental knowledge act as an important factor to consider when firms involve into green supply chain initiatives.

In addition, customer pressures or buying firm acts as a major stakeholder, who has the power to influence its suppliers for sustainable concerns. This imply that customers are increasingly asking for environmentally friendly car with environmental concerns include the green criteria in the purchasing contract and green company policy

However, environmental regulation was found to be the least loadings on the green participation driver from those factors (Loading = 0.32). This result is consistent with Giunipero et al, 2012, it may be better for government to reconsider their regulations and incentive programs.

#### 4. Conclusion

This research investigated the critical factors effecting supplier participation in green supply chain. The findings of this study confirm the general positive impact of three potential factors include environmental regulations, customer pressure and supplier management on supplier participation in green supply chain (Lee, 2008: Giunipero et al, 2012: Caniels et al, 2013: Laosirihongthong et al, 2013).

Manufacturing manager must now focus on improving the supply chain management in order to improve organization performance. Green supply chain management is now a major concern that companies must deal with. The greening of suppliers can increase on buyer competitiveness and financial performance (Rao, 2005). Auto parts manufacturers should improve their products combining with the use of environmentally friendly materials to comply with customer and regulation requirements.

This study has demonstrated that environmental regulations, customer pressure and supplier management and organization are found to be the significant factor to drive green

participation of its supplier. However, the findings of this study indicated that environmental regulations are found as the lowest driver for supplier participation. This consistent with the result of Giunipero et al, (2012), this imply that manager felt that there was a lack of positive incentive to drive enterprises' effort in green practices. It may be the good reason for government policy maker to reconsider their green initiatives for Thai auto parts firms since they appear to be insufficient to encourage to the green efforts.

## 5. Recommendations

The result of this study is useful for managers in Thai auto parts manufacturing. Management should place strong emphasis on three potential of green factors. Supplier management and organization was found to be the most significant drivers. Thus, management plays an important role to drive the green implementation. Also, managers should conduct the environmental training in order to increase the employee's knowledge in green practices. This enables firms to encourage the participation of green activities and management with suppliers.

Future research should consider other relevant green factors for the supplier participation in green supply chain. In addition, future studies should carry out their research in a variety of contexts of different industries, thereby providing the better understanding of how green factors affect the supplier participation in green supply chain.

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