Discussing Green Environmental Performance and Competitive Strategies

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Abstract

Green Production (GP) requires firms to consider their products and related environmental management simultaneously and include the principle of environmental protection in their management mechanisms. The purpose of the GP is to promote green products and enhance market competitiveness. To meet GP specifications, green suppliers must include GP among their management system and refer to ecofriendly requirements and practices as tools for establishing their own green production management system (GPMS). This approach can resolve difficulties encountered when producing green products and improve businesses' green competitiveness. In this study, we used the simultaneous importance - performance analysis (SIPA) model to investigate the green performance of the case company and its competitors.

Keywords: green environmental performance, environmental protection laws, green laws

1. Introduction

Green production (GP) can be defined as a production process developed based on the principle of ecological and environmental protection for manufacturing green products and satisfying green consumption requirements. The two primary objectives of GP are as follows: (a) To eliminate or reduce the generation and emission of wastes and pollutants during the production process and rationally utilize resources, thereby promoting product production and consumption processes that are compatible with

the environment, which reduces the damage to humans and the environment. (b) To slow resource depletion by effectively using resources, identifying alternatives to rare resources, reusing resources, and conserving energy, materials, and water. (Despeisse et al., 2012; Cheng et al., 2013).

Establishing a GP provides advantages and disadvantages. The advantages are listed as follows. Enterprises that encounter fierce market competition can form an alliance to implement a GP and, therefore, integrate with upstream and downstream enterprises in the GSC (Green Supply Chain) to complement one another and produce benefits for the entire supply chain. In addition, GSC-based enterprises can establish an image signifying that the enterprises produce safe and reliable products and accept social responsibility, thereby enhancing the enterprises' green image and obtaining customer loyalty. Regarding the disadvantages, although a GP can enhance the efficiency of resource use and reduce costs to a certain degree, green recycling and waste disposal requires substantial cost, thus generating deficits. In addition, technology and knowledge required for implementing a GP are currently inadequate. Although a GP can be established theoretically, technologies and measures for developing green products and disposing of waste require improvement. (Chiang et al., 2011; Izunildo, et al., 2012; Tsireme et al., 2012).

For businesses, implementing GP and becoming a green supplier (GS) entail advantages and disadvantages. The advantages are that businesses that use GSs can improve their green image and gain customer trust by demonstrating that their products are safe and reliable and that they attach considerable importance to their social responsibility. The disadvantages are that despite GP improves resource usage efficiency, which lowers costs, the costs of green recycling and waste treatment processes are extremely high, to an extent that the costs incurred outweigh the costs saved.

Based on the GP concept, this study examined GS competitive attributes and competitive strategies in a GSC. In this study, we used the simultaneous importance-performance analysis (SIPA) model to investigate the green performance of the case company and its competitors.

2. Literature Review

2.1 Green Supply Chain and Green Supplier Assessments

Walton, Haldfield, and Melnyk (1998) stated that GSC includes five processes: procurement, raw material management, transportation, packaging, and recycling and reverse logistics. Processes influencing green performance such as procurement, transportation, pollution, and recycling management are components of crucial green management decisions that businesses must make. (Chiang et al., 2011; Sameer, Steve, and Tobias, 2012; Tsireme et al., 2012; Payman and Cory, 2013; Constantin, Daniel, and Antony, 2014).

General GS assessments involve evaluating four major functions in a management system, which are the establishment of an environmental information platform, pricing and negotiation, tracking and control, and technology and strategy development, as shown in Fig. 1.

These four functions are elaborated as follows:

(1) Environmental information platform

An environmental information platform facilitates favourable communication between businesses and their suppliers. World-renowned businesses such as Sony, Apple, Intel, and Ford have already adopted this platform, to which audit forms are uploaded and suppliers are required to provide related information by regularly reporting their GP operational details and objectives on this platform. This allows businesses to gain insight into the environmental impact created and the clean and green technologies that suppliers use during the manufacturing process. Through this platform, businesses are able to access information regarding environmental policies, goals, regulations, and reports.

(2) Pricing and negotiation

Following a GS assessment, suppliers are ranked based on the scores they receive for each evaluation criteria. In addition, their green performance can be used as a bargaining chip when negotiating procurement contracts; in other words, the higher the performance level, the less likely suppliers will lower their procurement fee.

(3) Tracking and control

Suppliers are categorized based on their green performance into Groups A, B, and C. Group A is approved suppliers, Group B includes temporarily approved suppliers who require further improvements, and Group C is disapproved suppliers who demonstrate poor green performance. Therefore, suppliers in Group C must be educated on environmental concerns to increase their performance level and competitiveness.

(4) Technology and strategy development

Renowned businesses will cooperate with suppliers who exhibit favourable green performance to create and develop products. For example, Green Partners is a new alliance formed between Sony and its suppliers.

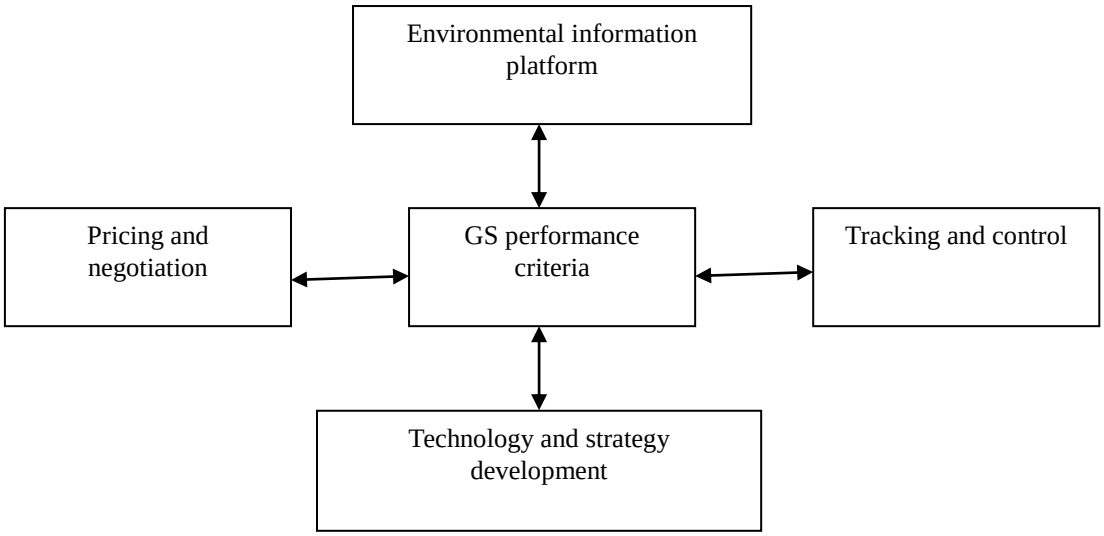

Figure 1. Evaluation of management functions using the GS criteria

2.2 Competitive Attributes and Competitive Strategy of GSs

Traditional studies on the competitive attributes and strategies of GSs have the following two deficiencies. First, the majority of these studies have assumed that all attributes are independent and that no influential and causal relationships exist among them. Second, several studies have assumed that the weight of the attributes is identical.

Because businesses all play various roles in a supply chain, their green performance improvement methods and competitive strategies should be distinct. Thus, analysing the strengths and weaknesses of a business in its green performance can improve its resource allocation, resource usage efficiency, and green performance. By referring to this study's literature review concerning GS assessment criteria and competitive strategies, we developed 10 competitive attributes for GSs, which were divided into the following four dimensions:

(1) Green manufacturing performance: waste gas emission, wastewater discharge, and hazardous waste;

(2) Environmental management performance: the effectiveness of environmental management system, continued compliance with relevant laws, and complete internal management procedures;

(3) Green management performance: green sales and green image; and

(4) Green product performance: volume of products recycled and green product packaging.

3. Study Methods

3.1 Simultaneous Importance-Performance Analysis

Burns (1986) proposes the analysis method of synchronized importance and performance. This method can easily analyze the importance of the competitive character, the performance and the performance of the competitors. The basic application of SIPA is to compare the company and its competitor. The

number of characters for investigation shall be first selected; questionnaires shall be then be sent out and obtain the importance degree based on the customers' point of views; then, it shall be divided by "High" and "Low". Afterward, the customers are invited to proceed into separate assessment of the company's and the competitor's characters and divided into "Poor" and "Good". Last, eight competitive status given by Burn respectively are obtained. The market competitive strategies are compiled in Table 1. (Yavas and Shemwell, 1997; Bei, 2006; Tsai et al., 2013)

(1) Neglected Opportunity

This indicates a high degree of importance of the character, for which both the company and its competitor are not having good performances. This would be an ignored potential opportunity. Whoever takes this advantage and invest resources, it can possibly dominate the customers.

(2) Competitive Disadvantage

This indicates a high degree of importance of the character, yet the company has dropped behind the competitor. Thus, the company might fall into a competitive disadvantage situation that might cause significant damages. This shall be immediately fortified and improved.

(3) Competitive Advantage

This indicates a high degree of importance of the character, and the company has better performance than the competitor. This means that the company is situated in a more advantaged place, for which this situation shall be protected and kept in log-term period.

(4) Head-to-Head Competition

This indicates a high degree of importance of the character, and both the company and the competitor have good performances. Both must keep the good performance with any negligence.

(5) Null Opportunity

This indicates a low degree of importance of the character, and both the company and the competitor do not have good performances, meaning that this is a false opportunity. The customers would not be more willing to use the product or the service even though the character is enhanced.

(6) False Alarm

This indicates a low degree of importance of the character, but the competitor has a better performance than the company. This is only a false alarm as it would not affect the company in terms of the customers. No special responses shall be made.

(7) False Advantage

This indicates a low degree of importance of the character, but the company has a better performance than its competitor. This is a false competitive advantage as it has no other profitable returns. The company can consider to recycle and to relocate the resources into other areas.

(8) False Competition

This indicates a low degree of importance of the character, but the company and its competitors have good performances, which show excessive competition. The company can consider recycling and relocating resources in other areas.

The SIPA analysis method is an easy way to demonstrate the state of the character and improvement method. It is used by many scholars in other fields as a way to analyze the improvement priorities and to satisfy the customers' demands as well as a tool for enhancing the company's competitiveness .

The use of SIPA enables businesses to analyse not only their own performance but also that of their competitors. It enables businesses to determine performance differences between itself and its competitors in the attributes that clients consider valuable. Businesses can thus devise corresponding competitive strategies to allocate their resource investment.

Because of the advantages of Burns' SIPA model in 1986, it has subsequently been used in various studies, including the study by Lee and Hsieh (2011) applied SIPA to analyse the competitive advantage, competitive disadvantage, and competitive strategies of telecommunication service operators. Tsai et al., (2013) employed SIPA to investigate how manufacturing companies acquire additional purchase orders and maintain a competitive advantage.

Table 1. Simultaneous importance-performance diagnostic grid

Importance of the attribute	Performance of the business	Performance of the competitors	Simultaneous Result
HIGH	POOR	POOR	Neglected opportunity
		GOOD	Competitive disadvantage
	GOOD	POOR	Competitive advantage
		GOOD	Head-to-head competition
LOW	POOR	POOR	Null opportunity
		GOOD	False alarm
	GOOD	POOR	False advantage
		GOOD	False competition

4. Results and Discussion

The subject of this research's case study is based on a Taiwanese printed circuit board (PCB) manufacturing company X. PCB is the core material for the electronic materials, the support of the electronic component, and the electronic components connected to the main line.

According to the 2014 Prismark Laminate Report, Companies X, Y, and Z were respectively ranked seventh, sixth, and tenth according to their global market share. We used Company X as the case company and selected Companies Y and Z as its competitors to explore their green performance competitive attributes and competitiveness.

4.1 Study Questionnaire

Both questionnaires comprised four dimensions and 10 attribute items. The four dimensions were green manufacturing process performance, environmental management performance, green management performance, and green product performance. The 10 attributes were waste gas emission (a1), wastewater discharge (a2), hazardous waste (a3), the effectiveness of environmental management system (b1), continued compliance with relevant laws (b2), complete internal management procedures (b3), green sales (c1), green image (c2), volume of products recycled (d1), and green product packaging (d2).

The SIPA questionnaire was used to investigate the importance and performance of the 10 criteria for Companies X, Y, and Z. The questionnaires were distributed between March 1, 2014 and March 15, 2014. In the questionnaire, a 7-point Likert scale was adopted, in which 1 and 7 indicated "*strongly disagree*" and "*strongly agree*," respectively. The importance and performance levels were examined using close-ended question items. A total of 20 questionnaires were administered to the deputy director of procurement, vice president of technology, or the general managers of 20 global companies that purchase PCB substrates. Of which, 16 valid questionnaires were returned, indicating a return rate of 80%.

4.2 Simultaneous Importance-Performance Analysis Results

We used the average importance score (5.39) as the standard and rated the importance level as "high" or "low" accordingly. Concerning business performance, we used the average company performance as the basis, rating the performance of each business as "good" or "poor," as shown in Table 2.

To analyse the market competition between Company X and Companies Y and Z, the competitors of Company X were considered as one unit. The market share of Companies Y and Z was then used to calculate their weighted performance. Based on the importance of each attribute, the performance of Company X, and the weighted performance of Companies Y and Z, the marketing strategies of Company X were devised using SIPA. The results are shown in Table 3.

The SIPA results indicated that Company X had a competitive advantage in the attributes of waste gas emission (a1), hazardous waste (a3), effectiveness of environmental management system (b1), and continued compliance with relevant laws (b2). These four attributes were Company X's strengths and

should be maintained to achieve favourable green performance. Regarding wastewater discharge (a2) and volume of products recycled (d1), Company X was at a competitive disadvantage and, thus, is required to gather resources to increase the competitiveness of these two attributes to obtain a competitive advantage and improve its green performance. Concerning green sales (c1) and green image (c2), Company X possessed a false advantage. Although the company exhibited superior performance compared with that of its competitor, these attributes had a low level of importance to clients and the company should consider transferring resources to other aspects. The attribute, green product packaging (d2), is classified as a false alarm. Although Company X exhibited performance inferior to that of its competitors, this criterion had a low level of importance to clients; thus, it would not influence the company's green performance.

4.3 Discussion

To improve Company X's green performance, the nature of the market competition between Company X and its competitors must first be identified; in other words, the attributes that contribute to its competitive advantage, competitive disadvantage, and false advantage must be determined.

The SIPA results indicated that Company X had a competitive advantage based on the attributes of waste gas emission (a1), hazardous waste (a3), effectiveness of environmental management system (b1), and continued compliance with relevant laws (b2). These four attributes are Company X's strengths and should be maintained.

Company X was at a competitive disadvantage based on wastewater discharge (a2) and volume of products recycled (d1). Therefore, it must gather resources to increase the competitiveness of these two attributes.

Despite that Company X exhibited superior performance regarding green sales (c1) and green image (c2) compared with that of its competitors, it was at a false advantage because clients did not value these attributes highly.

The SIPA results indicated that Company X underperformed its competitors regarding green product packaging (d2). However, this was a false alarm because clients considered this attribute insignificant.

Both Company X and its competitors excelled in the performance of complete internal management procedures (b3), which is an attribute of high importance that provided them with head-to-head competition. Therefore, their performance in this regard should be carefully maintained.

Table 2. SIPA of the 10 GS attributes

Item	Attributes	Importance		Performance						
				Company X		Company Y		Company Z		Average performance of the three companies
a1	Waste gas emission	High	5.74	Good	5.82	Good	5.73	Poor	5.35	5.63
a2	Wastewater discharge	High	5.81	Poor	5.51	Good	5.65	Poor	5.45	5.54
a3	Hazardous waste	High	5.52	Good	5.62	Poor	5.37	Poor	5.53	5.51
b1	Effectiveness of environmental management system	High	6.16	Good	6.16	Poor	5.93	Poor	6.03	6.04
b2	Continued compliance with relevant laws	High	5.06	Good	5.15	Good	5.77	Poor	5.42	5.45
b3	Complete internal management procedures	High	5.70	Good	5.71	Good	5.74	Poor	5.32	5.59
c1	Green sales	Low	4.65	Good	5.56	Poor	4.46	Good	4.52	4.85
c2	Green image	Low	4.95	Good	5.02	Good	4.93	Poor	4.32	4.76
d1	Volume of products recycled	High	5.50	Poor	4.50	Poor	4.53	Good	4.63	4.55
d2	Green product packaging	Low	4.83	Poor	5.02	Good	5.14	Good	5.12	5.09
	Average	5.39								

Table 3. SIPA of competitive strategy

Item	Attributes	Importance		Performance of Company X		Weighted performance of Company X's competitors		Competitive marketing strategy
a1	Waste gas emission	High	5.74	Good	5.82	Poor	5.59	Competitive advantage
a2	Wastewater discharge	High	5.81	Poor	5.51	Good	5.58	Competitive disadvantage
a3	Hazardous waste	High	5.52	Good	5.62	Poor	5.43	Competitive advantage
b1	Effectiveness of environmental management system	High	6.16	Good	6.16	Poor	5.97	Competitive advantage
b2	Continued compliance with relevant laws	High	5.06	Good	5.15	Poor	5.64	Competitive advantage
b3	Complete internal management procedures	High	5.70	Good	5.71	Good	5.58	Head-to-head competition
c1	Green sales	Low	4.65	Good	5.56	Poor	4.48	False advantage
c2	Green image	Low	4.95	Good	5.02	Poor	4.70	False advantage
d1	Volume of products recycled	High	5.50	Poor	4.50	Good	4.57	Competitive disadvantage
d2	Green product packaging	Low	4.83	Poor	5.02	Good	5.13	False alarm

5. Conclusion

The study results indicated influential and causal relationships among the 10 green performance attributes. Overall, Company X should continually invest resources in maintaining the effectiveness of its environmental management system (b1) and continued compliance with relevant laws (b2) to maintain its competitive advantage in the market. This would enhance its green performance and increase the competitiveness of the other attributes. Moreover, Company X must gather resources to solve the problem concerning the volume of products recycled and thereby avoid the irreversible consequences of being outperformed by competitors.

We recommend that future researchers employ the proposed SIPA model for investigating other research topics, industries, and case studies to develop other criteria assessment systems.

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