Relationship between Market Competition and Green Supply Chain Management Practices in Manufacturing Industry

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***Abstract* - There is a growing market and institutional demands for companies to implement green practices to produce environment friendly products and services. Therefore, more companies are integrating the green practices into their operations, which have increased the market competition. In order to improve their competitiveness in the market, companies are forced to adapt to changing market requirements by implementing practices that could differentiate themselves, such as green supply chain management (GSCM). This study aims to understand the relationship between market competition and GSCM practices among manufacturing companies in Penang and Johor, Malaysia. Data gathered from a survey among the companies were analyzed using descriptive and correlation analysis. The results revealed that the level of market competition in the manufacturing companies' business environment and the implementation of GSCM practices were relatively moderate. A Spearman's correlation analysis show that market competition had a moderate positive relationship with all GSCM practices studied, namely green purchasing, product eco-design, cooperation with customers, reverse logistics and internal environmental management. The findings highlight the role of market competition in promoting environment friendly behavior in manufacturing industry. In addition, they also show that more should be done by the industry to improve the sustainability of their supply chain practices.**

Keywords *- Green supply chain management, market competition, manufacturing industry*

1. Introduction

Industrial growth increases the level of energy and material utilization that can cause environmental and resource consumption problems. Green supply chain management (GSCM) has been introduced as a management strategy to address these issues, among others, which combines environmental protection into supply chain management activities [1], Nowadays, more organizations are starting to incorporate GSCM practices into their operations that could help improve environmental sustainability of products and services.

GSCM has gained popularity among manufacturers due to its ability to reduce the risk of environmental damages as well as increase operational performance and profits [2]. GSCM refers to an integration of environment friendly strategy into supply chain activities such as sourcing, product design, and transport and distribution [3]. GSCM practices have been introduced as an actual means to pursue an environment focused strategy [4].

According to [5], participation of Malaysian companies in GSCM practices was low. However, increased pressure from customers and governments for products and services that are environment friendly has forced companies to consider integrating green practices in their supply chains [4]. For example, companies that export electronic products into the European Union must disclose the percentage of recycled or reused components in the products. Similarly, United Arab Emirates, Sweden and Taiwan require that companies must comply with hazardous material disclosure requirements for electronic devices [6]. Furthermore, market competition is increasing as companies need to adapt the changes in business environment for more sustainable supply chain practices. These factors create pressure for companies to improve supply chain sustainability in order to enhance their competitiveness [3]. Hence, market pressure encourage companies to become more competitive which will in turn help improve firm performance [7].

Current studies on GSCM practices in the manufacturing industry in Malaysia often focused on understanding how the practices can influence performance. However, there is still a lack of studies that examine the factors that could influence GSCM, especially in terms of market performance. This study, therefore, aims to identify: (1) the level of market competition in the Malaysian manufacturing

International Journal of Supply Chain Management
IJSCM, ISSN: 2050-7399 (Online), 2051-3771 (Print)

industry, (2) the GSCM practices being implemented in the industry, and (3) the relationship between market competition and GSCM practices. The findings can increase our understanding of GSCM strategies used by manufacturing companies as they adapt to market competition.

2. Literature review

2.1 Market competition

Market competition is an important factor that must be considered in strategic management because it can influence the behavior as well as performance of companies and industries [8]. A competitive market environment indicates the level of competition for companies to offer products that satisfy customers' requirements and [6]. Since customers have more buying power and options to choose from, their demands for product requirements can be more specific. According to [3], the factors used to measure competitiveness differ among the existing researches. For example, Testa and Iraldo (2010) argue that profit is the main indicator of competitiveness, while [9] used improvement in efficiency and quality as well as cost reduction to measure the factor.

Development of new technology, product and markets are among the main mechanisms that facilitate the formation of competitive markets [7]. Technology advances increases the demand for products with better quality. Consequently, companies must differentiate themselves and adapt to the changes in technological development to improve their competitiveness through product, process and market innovation [10]. Product differentiation offers more choices to customers, which at the same time increases competition between manufacturers. Companies could differentiate their products through, for example, quality improvement, fast delivery service, product design, new product development and uniqueness of product [11].

Nowadays, there are more demands for green products and services from customers due to their increasing awareness of the impact of industrial activities and products on the environment as well as safety and health [12]. In addition, customers' belief and values in sustainable behavior can influence their demand for green products. These customers are more likely to choose companies that offer green and quality products, where price is often secondary to their conscience in purchasing decision (Nuttavuthisit & Thøgersen, 2017). Thus, pressure from customers can promote market competition in offering green products and increase companies commitment towards environmental protection [6]. This could also help companies to improve profits, while reducing their impact on the environment.

These factors are among the drivers that encourage companies to adopt green supply chain practices. Specifically, increased market competition forced companies to further understand changes in customers requirements, which could eventually lead to the implementation of the GSCM practices [6]. In addition, as companies adapt to the changing environment and requirements, it will help them to remain competitive in the long run, while addressing the environmental concerns related to their products and processes [13].

2.2 Green supply chain management

Companies are becoming more aware of the strategic importance and the role of the environment in creating today's competitive [14]. Consequently, this has motivated manufacturing companies to integrate green approaches to improve their strategies and supply chain management practices [15]. GSCM is commonly used in the literatures to describe various activities conducted by organizations to minimize their impact on the environment [15]. According to Qinghua [1], collaboration between organizations is important for all GSCM strategies to ensure successful implementation throughout the supply chain channels so as to enhance competitive advantage, increase profit and achieve market share objectives. GSCM can also help to minimize waste as well as improve the quality of product-life and utilization of natural resources [16]. Table 1 shows GSCM strategies examined in the existing studies.

Table 1: Previous studies of GSCM strategies

GSCM strategies	Author (Year)
Green purchasing	Al Khattab et al. (2015), Hassan Younis et al. (2016), Caeiro et al. (2013), [6], Diab et al. (2015), [17], [4], Pandiyan et al. (2017), Saeed et al. (2018), [1], [2]
Product eco-design	Caeiro et al. (2013), [18], [6],[17], [4], Saeed et al. (2018),[1], [2]
Cooperation with customers	Al Khattab et al. (2015), [6], Diab et al. (2015, [4], Pandiyan et al. (2017), Perotti et al. (2015), Saeed et al. (2018)
Reverse logistics	Hassan Younis et al. (2016), Azevedo et al. (2011,[6], [17],[16], Pandiyan et al. (2017), Perotti et al. (2015)
Internal environmental management	Al Khattab et al. (2015), Caeiro et al. (2013),[6], Diab et al. (2015),[4], Saeed et al. (2018),[1], [2]

Purchasing function has specific responsibilities such as supplier selection, material selection and

negotiation with suppliers to meet the needs of products or services processing. Green purchasing is defined as an environment-oriented purchasing of products, materials or services that meet the concern of the environment in terms of reduction of waste, promotion of recycling, reuse, and substitution of materials [19]. Green purchasing includes awareness about government actions and support, beliefs about product safety and use, and availability of product and product information [20]. One of the most important functions of green purchasing is supplier selection. Manufacturing companies need to select supplier to order large amounts of raw materials, office goods and other products, in order to produce green products for customers. In addition, companies can collaborate with supplier to reduce packaging because this will reduce the impact of supply chain activities on the environment.

Product eco-design concerns about product design performance in relation to environmental, health and safety impact over its life cycle. Eco-design can be assumed as the process of designing environment friendly products and services by substituting materials or processes which have negative environmental impact with those which are less damaging [1]. For example, ensuring that minimal waste is produced by reducing packaging and avoiding the use of hazardous material [21]. In addition, in order to minimize environmental impact at the manufacturing stage, products or processes can be designed for reduction of energy used and minimization of the wastes. Hence, eco-design combines environmental criteria into product design process, taking into consideration complete flow of the product throughout its supply chain. This consideration is very important because most environmental impacts arising from production, consumption and disposal of the product are direct consequences of decisions made at the design stage such as raw materials, supplies, function of the products and processes [22].

Cooperation with customers refers to companies' effort to actively ask and consider customer feedback in developing green products, implementing eco-friendly manufacturing method and using eco-friendly packaging resources [1]. A collaborative supply chain organizes its partnerships to produce and distribute products and services for minimum organization's costs towards satisfying the customers' demands. The cooperation includes product eco-design, green packaging and cleaner production that aim at improving environmental performance [16].

Reverse logistics refers to the movement of goods from the point of consumption to the manufacturing sites [17]. It is the process of recovering the product from the end consumer for the purposes of capturing value or suitable disposal [16]. The process can include returning defective goods from customers to the suppliers or any companies acting as an agent to reverse logistics [23]. The aims of reverse logistics are to recycle, reuse, repair or remanufacture and carefully dispose products as well as materials [24]. It includes moving goods from their place of use, back to their place of manufacturing for reprocessing, refilling, repairs or recycling or waste removal [18].

Internal environmental management is the development of policies and objectives to ensure environmental conservation that includes evaluation of product's environmental impact and the related organizational responsibilities [25]. Significant direct environmental impacts are mainly associated with internal operations. These include production facilities, raw materials, waste, purchasing of goods and use of resources such as energy, paper and water [26]. The policies and objectives can be achieved through cooperative organizational culture that enable communication between different departments, thus increase the companies' ability to share knowledge and views on environmental management initiatives across departments [27]. In addition, senior management is a crucial driving force to successfully implement environmental innovations, technologies and activities [25] by increasing employee commitment, facilitating employee participation and developing training programs for the implementation of GSCM practices.

3. Methodology

This study aims to identify the relationship between market competition and GSCM practices in the Malaysian manufacturing industry. A survey was conducted among manufacturing companies in Penang and Johor to gather data. The two states were chosen because they have among the highest number of manufacturers in Malaysia. Specifically, there were 11,046 manufacturing companies in these states. The survey samples, which is 370 [28] were chosen using simple random sampling. The target respondents of the survey were top management and managers of supply chain related departments. The questionnaire used for the survey was developed based on the literature review and distributed to the sample companies through email. It used five-point Likert scale (i.e. very low to very high) to measure the level of market competition and the implementation GSCM practices. Data gathered were analyzed using descriptive and correlation analysis. Since the data were not normally distributed, Spearman's correlation was used to test the relationship between market competition and GSCM practices.

4. Results and Analysis

This section discusses the results of a survey conducted among 370 manufacturing companies in Penang and Johor, Malaysia. Overall, 52 sets of questionnaire were collected, which makes the return rate as 14.05%. Table 2 shows the profile of the participating companies and respondents. Generally most of the companies were small and medium-sized, and involved in fabric or leather products manufacturing sector (57.7%).

Table 2. Profile of companies and respondents

Variable	Details	Frequency	Percentage
Position in company	Manager	14	26.9
	Supervisor	9	17.3
	Executive	11	21.2
	Others	18	34.6
Primary area of job function	Corporate Executives	7	13.5
	Operations/Production	14	26.9
	Purchasing/Inventories	7	13.5
	Planning	19	36.5
	Others	5	9.6
Industry	Food products	6	11.5
	Plastic products	5	9.6
	Electric and electronic products	9	17.3
	Fabric or leather products	30	57.7
	Others	2	3.8
Company establishment	Less than 10 years	20	38.4
	11 – 20 years	17	32.7
	21 – 30 years	8	15.4
	More than 31 years	7	13.4
Size of company	Less than 250 employees	32	61.5
	250 -500 employees	11	21.2
	501 -750 employees	1	1.9
	751 -1000 employees	2	3.8
	More than 1000 employees	6	11.5

Table 3 shows the results of descriptive analysis of market competition level in the manufacturing industry. Generally, the companies that participated in this study indicate that the level of competition in their market is below moderate. Among the factors used to measure the variable, competition in product market has the highest mean value, which is 2.50.

Table 3. Level of market competition in the manufacturing industry

Factors	Mean	Standard deviation
Competition in product market	2.50	0.90
Institutional and market pressure for environment friendly product	2.21	0.80
Market awareness of environmental issues	2.21	0.92
Average	**2.31**	**0.87**

The results of descriptive analysis for GSCM practices are shown in Table 4. The analysis revealed that the GSCM implementation among the companies studied were slightly above the moderate level. Cooperation with customer has the highest mean score at 3.48, while reverse logistics scored the lowest (3.04). The results show that the companies cooperate with customers most for product design and packaging. This echoes the result of product eco-design analysis, where companies were focused on designing products with materials or parts that can be reused or recycled. The strategy that scored the lowest mean is supplier selection based on ISO 14001. In addition, the result also indicates that the level of cross-functional cooperation for environmental improvements is relatively low among the companies studied. The same was revealed for the practice of collecting and taking back product at the end of its life cycle.

Table 4. Level of GSCM practices implementation

	Mean	Standard Deviation
Green purchasing		
Cooperation with suppliers to enhance environmental quality	3.27	0.79
Cooperation with suppliers to reduce packaging that have negative impact on environment	3.21	0.87
Use ISO 14001 as an important factor for selecting suppliers	2.85	0.92
Average score	**3.11**	**0.86**
Product eco-design		
Design products to reduce material waste or energy consumption	3.40	0.91
Design products to increase the reuse and recycle of material and component parts	3.63	0.84
Product design that avoids or reduces the use of hazardous materials in the manufacturing process	3.19	0.79
Average score	**3.41**	**0.85**
Cooperation with customer		
Cooperate with customers for product eco-design	3.63	0.86
Cooperate with customers for green packaging	3.67	0.90
Cooperate with customers for cleaner production	3.15	0.83
Average score	**3.48**	**0.86**
Reverse logistic		
Collect and take back end-of-life cycle products	2.96	0.97

Collect and take back packaging materials	3.00	0.93
Use information systems to handle reverse logistics	3.17	1.02
Average score	**3.04**	**0.97**
Internal environmental management		
Commitment of GSCM from senior managers	3.12	0.70
Support for GSCM from mid-level managers	3.15	0.70
Cross-functional cooperation for environmental improvements	2.94	0.75
Average score	**3.07**	**0.72**

Table 5 shows the results of correlation analysis between market competition and GSCM practices. Reliability and normality test were conducted before the analysis. The reliability test revealed that the Cronbach's alpha values of all variables were well above 0.7, which satisfies the limit of internal consistency for the instrument used to measure them [29]. The Kolmogorov-Smirnov (K-S) test shows that the data gathered were not normally distributed since the *K-S* values of all variables were significant (<0.05). Therefore, Spearman's correlation was used to test the correlation between market competition and GSCM practices in the companies studied. The results of the correlation analysis are summarized in Table 5.

Table 5. Results of Spearman's correlation test

	Market competition
Green purchasing	0.35*
Product eco-design	0.31*
Cooperation with customers	0.39**
Reverse logistics	0.34*
Internal environmental management	0.43**

**p < 0.01 (2-tailed), *p < 0.05 (2-tailed)

The results of the correlation analysis show that market competition had a moderate significant positive relationship with all GSCM practices. Specifically, market competition had the strongest correlation with internal environmental management ($r = 0.43$, $p < 0.01$), while product eco-design has the weakest relationship with market competition ($r = 0.31$, $p < 0.05$). The results will be discussed further in the next section.

5. Discussion, Conclusion and Recommendation

This study aims to understand the relationship between market competition and GSCM practices. A survey was conducted among manufacturing companies in Penang and Johor, Malaysia. Overall, 52 companies participated in the survey, making the response rate to about 14.05%. The descriptive analysis of data gathered from the companies revealed that the level of market competition in their business environment and the implementation of GSCM practices were relatively moderate. A Spearman's correlation analysis was used to test the relationship between the variables. The results show that market competition had a moderate positive relationship with all GSCM practices studied, namely green purchasing, product eco-design, cooperation with customers, reverse logistics and internal environmental management.

The findings of this study are in line with Choi's [6] study. Market pressure will motivate companies to implement GSCM practices to remain competitive by offering products and services that are environment friendly as well as improving their commitment towards environmental protection [6]. According to [3], GSCM implementation can be integrated into companies' strategic management decisions to help them gain competitive advantage in the global market. Factors such as market and institutional demand, technological changes and environmental pressure force companies to continuously adapt to the changing market environment and preference [7]. Therefore, in order to ensure long-term sustainability of business operations and profits, companies must implement GSCM strategies that could facilitate their adaptation to the changing environment. This is especially important, as markets are increasingly more inclined to favor supply chains that focus on minimizing or eliminating their negative impact on the environment. In addition, as society's awareness of the environmental impact of industrial activities and products increased, there will be more demand for environment friendly products. This will encourage companies to companies to differentiate themselves to gain competitive advantage by implementing innovative strategies that could address customer requirements and, at the same time, provide positive impacts to the companies and the environment [13].

Future studies on this topic could focus on the larger population of manufacturing industry in Malaysia. This could address the generalizability issue of the findings of this study due to the lack of data obtained. In addition, case studies could be conducted to further examine the level as well as characteristics of market competition in different manufacturing sectors and how it could influence companies' GSCM practices. Researches could also investigate the influence of GSCM practices on companies' competitiveness, and eventually their supply chain performance. The findings could help us gain better understanding of how GSCM strategies can used to help companies gain competitive advantage in the markets and sustain in the long run.

Acknowledgements

This research was supported by Ministry of Education of Malaysia's FRGS grant Vot. 1601 and Universiti Tun Hussein Onn Malaysia.
IJSCM, ISSN: 2050-7399 (Online), 2051-3771 (Print)

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