

The Relationship between Green Supplier Development Strategies and Firm Performance

Khoo Bao Ming¹ & Wan Nurul Karimah Wan Ahmad^{1,*} & Alina Shamsuddin¹

¹Department of Management and Technology, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, 86400 Batu Pahat, Johor, MALAYSIA

*Corresponding Author

DOI: <https://doi.org/10.30880/rmtb.2021.02.02.018>

Received 30 September 2021; Accepted 01 November 2021; Available online 01 December 2021

Abstract: Society nowadays is more concerned about environmental issues compared to the previous generations. Companies, especially in the manufacturing sector, are considered as one of the main contributors to the rise of environmental issues caused by their supply chains activities. Having suppliers that are equipped with green capabilities can help companies reduce their supply chain impact. This study focuses on identifying the relationship between green supplier development strategies and firm performance. A survey was conducted among 370 manufacturing companies in Malaysia, where 58 questionnaires distributed to the companies were returned. Data collected were analysed using descriptive and correlation analysis. The results show that information sharing and training for supplier have a high relationship with firm environmental performance. In addition, good relationship between companies and their suppliers tend to increase economic performance.

Keywords: Green supplier development, Firm performance, Manufacturing industry

1. Introduction

The global movement towards green and more sustainable business strategies plays an important role in today's global supply chain management. Effective supplier selection is one of the most significant supply chain's success factors. Therefore, it may not be sufficient to choose the best supplier based on cost, quality, delivery, reliability, and efficiency. Industries should also integrate environmental aspects with respect to supplier's sustainability (Sahu *et al.*, 2012). In order to achieve sustainable development to balance environmental, economic and social performance, every company in a supply chain right from the supply sources should implement effective green strategies. It can reduce the environment impact in the whole supply chain of an organization from the production process to the end-of-life of a product (Yu & Hou, 2016).

The implementation of the green supplier development strategies is an environment friendly approach as it promotes a greener way in managing the supply chain (Azevedo *et al.*, 2011). This practice is essential in manufacturing company as it facilitate for green materials, practices and process be embedded in the supply chain from its sources. However, not all firms pursue green supplier development because the initiatives require additional financial resources and efforts by the companies involved (Mudgal, 2010).

According to Xu & Peng (2018), a lot of companies lack the understanding on how to implement supplier development strategies and how it can affect their performance. With the increased pressure to address the environmental issues such as resource use and materials sustainability, the development of suppliers plays an indispensable role in the management of the green supply chain. Instead of re-evaluation in the selection of new suppliers that cost a lot, companies should develop their existing suppliers to improve the supply chain overall performance. This paper aims, therefore, aims to understand the relationship between green supplier development strategies and firm performance among manufacturing companies in Malaysia.

2. Literature Review

Nowadays, the increase in environmental awareness in societies has increased the pressure on companies to improve green practices in their supply chain. The supply chain literature is giving more attention to the development of suppliers with environmental objectives. According to Thakker *et al.* (2018), green supplier development requires the effort between companies and their suppliers to execute the development strategies such as supplier environmental training, on-site interaction with suppliers’ manufacturing operation and processes to improve green practices, and collaborative project to build green technologies. The environmental supplier training proposed by the researcher is to promote the initiative such as reduction of pollution reduction, advanced waste management and resource efficiency.

The literatures on green supplier development strategies are expanding. A review of the literature revealed that there are various strategies that can be used to integrate green practices into suppliers’ operations. The strategies can be grouped into five categories as summarized in Table 1.

Table 1: Green supplier development strategies (GSDS)

Categories	Strategies	Author (Year)
Provide training for supplier	1. Train supplier employees on environmental issues.	Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
	2. Train supplier in stakeholder expectation.	Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Dou <i>et al.</i> , (2014); Akman (2015); Bai <i>et al.</i> , (2016).
	3. Formal process for supplier development	Fu <i>et al.</i> , (2012); Bag <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Bai <i>et al.</i> , (2016).
Information sharing	1. Give green technology advice to suppliers	Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Akman (2015); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
	2. Give eco-design product development related advice to supplier	Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Akman (2015); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).

	3. Information sharing on environmental topic	Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Akman (2015); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
Evaluation and assessment on supplier	1. Supplier environmental evaluation and feedback	Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Xu <i>et al.</i> , (2018); Awasthi <i>et al.</i> , (2016); Akman (2015); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
	2. Providing feedback about supplier environmental performance	Blome <i>et al.</i> , (2014); Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Bai <i>et al.</i> , (2016).
	3. Firm eliminates any kind of non-value activities in supplier process	Bag <i>et al.</i> , (2018); Akman (2015).
	4. Setting environmental improvement targets for suppliers	Bai <i>et al.</i> , (2010); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Bai <i>et al.</i> , (2016).
	5. Requiring ISO 14000 certification for suppliers	Fu <i>et al.</i> , (2012); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
Supplier relationship	1. Long-term contract with environmental dimension incorporate	Fu <i>et al.</i> , (2012); Dou <i>et al.</i> , (2014); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
	2. Build top management commitment/ support for supplier organization for green supply practice	Fu <i>et al.</i> , (2012); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Bai <i>et al.</i> , (2016).
	3. Support cross-functional team plays an important role in supplier development	Bag <i>et al.</i> , (2018); Xu <i>et al.</i> , (2018); Thakker <i>et al.</i> , (2018).
	4. Firm's personnel conduct site visit to their supplier's premise to help them improve performance	Blome <i>et al.</i> , (2014); Bag <i>et al.</i> , (2018); Akman (2015).
	5. Finance supplier major capital environmental expenditure	Blome <i>et al.</i> , (2014); Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).
	6. Providing environmental protection equipment and tools for supplier	Xu <i>et al.</i> , (2018).
	7. Transferring employee with environmental expertise to suppliers	Xu <i>et al.</i> , (2018); Dou <i>et al.</i> , (2014); Awasthi <i>et al.</i> , (2016); Bai <i>et al.</i> , (2016).
	8. Joint and team problem solving on environmental issues	Blome <i>et al.</i> , (2014); Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Dou <i>et al.</i> , (2014); Bai <i>et al.</i> , (2016).
Improvement on company supply chain	1. Build top management commitment/ support within buyer organization for green supply practice.	Fu <i>et al.</i> , (2012); Awasthi <i>et al.</i> , (2016); Akman (2015); Bai <i>et al.</i> , (2016); Thakker <i>et al.</i> , (2018).

- | | |
|--|--|
| 2. Firm invites supplier’s personnel to their site to increase their awareness of final product application. | Bag <i>et al.</i> , (2018); Akman (2015). |
| 3. Develop supplier environmental assessment programs. | Fu <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Akman (2015); Bai <i>et al.</i> , (2016). |
-

The practices found include provide training for suppliers, information sharing, evaluation and assessment on supplier, supplier relationship, and improvement on company supply. Collaboration between company and supplier can bring greater benefits for the company. Implementation of the GSDS will increase the supplier performance. The strategies uses for supplier development in company’s supply chain will increase the efficiency and effectiveness (Xu *et al.*, 2018). Bag *et al.* (2018) supported Xu *et al.* (2018) findings and added that stable collaborative in supply network ensure the good outcome in company sustainability programs. In the supplier relationship with the company, good communication between two parties is important for the implementation of green supplier development strategies. It also promotes better coordination in the operation and resources planning for the company. Good supplier relationship will ensure that equal profit and risk sharing between company and suppliers.

However, company may face some barriers to implement the GSDS when the strategies require high investment. The feasibility in those strategies that require high investment depends on the resources that the company have. Company with limited resources will have to choose strategies that are suitable for them to implement (Bai *et al.*, 2010). Resource allocation from the company is crucial to implement some of the green supplier development strategies that require higher investment capital. Not all suppliers are able to cope with certain strategies due to the limited capital they have in hand (Fu *et al.*, 2012). According to Dou *et al.* (2014), not all the GSDS will promote operational and environmental outcome equally. Some of the GSDS is unable to implement at the same time due to the limited resource and capability of the management team to ensure the effectiveness of the strategies used.

The similarity among these green supplier development strategies is that they have a positive effect on firm’s environmental performance (Awasthi *et al.*, 2016). Company might have to decide which strategies is best fit with their supplier in order to achieve a good environmental performance for both the suppliers and the company itself. The combination of few suitable green supplier development strategies under a company is important to boost the business performance, as there is no single supplier development strategy alone can effectively achieve it (Bai *et al.*, 2016).

Based on Xu *et al.*, (2018)’s study, two performance measurements are mentioned in the research, which include environmental performance and economic performance. These measurements are relevant to green supplier development topic where environmental measurement should take into consideration on evaluating performance as it is about green approach taken by the firm. Table 2 shows the definition of environmental and economic performance.

Table 2: Definition of firm performance

Firm performance	Definition	Author
Environmental performance	Environmental performance relates to the ability of industrial facilities to minimize air pollution, effluent and solid waste, and to minimize the use of dangerous and toxic materials.	Green <i>et al.</i> (2012)

Economic performance	Economic performance relates to the capacity of the manufacturing plant to reduce the costs of purchased goods, energy usage, waste management, waste disposal and fines for environmental accidents.	Namagembe <i>et al.</i> (2019)
----------------------	---	--------------------------------

Environmental performance is a measure that seeks to reduce air pollution, effluent and solid waste and to minimize the use of hazardous and toxic materials in companies operations (Green *et al.*, 2012). Table 3 shows the factors that can be used to measure environment performance of a company. Environmental performance assessment of suppliers is the first step in developing green suppliers. Suppliers who achieve low environmental performance could be assisted through a lot of green supplier development programs such as ISO 14000 certification, supplier training and resource sharing (Awasthi *et al.*, 2016).

Table 3: Environmental performance measurement

Measurement factors	Author (Year)
Reduce air pollution	Green <i>et al.</i> , (2012).
Reduce effluent	Green <i>et al.</i> , (2012).
Reduce solid waste	Green <i>et al.</i> , (2012); Bai <i>et al.</i> , (2010); Awasthi <i>et al.</i> , (2016); Blome <i>et al.</i> , (2014).
Reduce hazardous, harmful, toxic material	Green <i>et al.</i> , (2012); Xu <i>et al.</i> , (2018).
Reduce gas emission	Thakker <i>et al.</i> , (2018); Bai <i>et al.</i> , (2010); Awasthi <i>et al.</i> , (2016).
Reduce water emission	Bai <i>et al.</i> , (2010).
Advanced waste treatment	Thakker <i>et al.</i> , (2018).
Decrease the frequency for environmental accident	Xu <i>et al.</i> , (2018).

According to Akman (2015), environmental performance can be evaluated by the companies’ own initiative and the environmental performance of their suppliers. The collaborative relationship between companies and suppliers allows them to improve their environmental performance. Generally, companies should develop cooperative, connected and integrated relationships with their suppliers, assess the green performance of their suppliers and help suppliers on green issues through information sharing and other green supplier strategies.

Thakker & Rane (2018) support the finding of Akman (2015) and added that joint ecological effort is required from both the company and their supplier in order to achieve good environmental performance. A good environmental supplier training will promote a better result in emission reduction, waste treatment, and resource efficiency to the company and their suppliers. Continuous information sharing, training and education should provide to the supplier as it can constantly expose them with environmental related knowledge to encourage them to become more sustainable in the supply chain network (Bag *et al.*, 2018).

Economic performance refers to the capacity of the manufacturing plant to reduce the costs of purchased goods, energy usage, waste management, waste disposal and fines for environmental accidents (Green *et al.*, 2012). The economic performance of the firm also includes sales revenue, market share, and profit margin of the firm (Geng *et al.*, 2017). Firm should have the strategic partnership with the suppliers that have strong environmental and economic performance in order to improve the overall performance of the firm (Shen *et al.*, 2013). Table 4 summarizes the measurement of economic performance.

Table 4: Economic performance measurement

Measurement factors	Author (Year)
Reduce cost of purchased material	Green <i>et al.</i> (2012)
Reduce cost of energy consumption	
Reduce cost of waste treatment	
Reduce cost of waste discharge	
Reduce cost of fine for environmental accident	
Sales revenue	Geng <i>et al.</i> (2017)
Market share	
Profit margin.	

Based on the transaction cost theory mentioned by Xu and Peng (2018), green supplier development strategies can reduce the cost of procurement and shorten overall order. Moreover, the energy consumption, material use, waste emission and processing cost will also decrease due to the implementation of green supplier development strategies. This helps companies to achieve good economic performance by saving the overall production cost. This is also supported by Petljak *et al.* (2018) and added that firm should green the entire supply chain that includes strategic level, tactical level and operational level in order to achieve greater economic performance. Based on the researcher finding, green supply chain process does not directly impact on the economic performance, but it helps in achieving good result in environmental performance, which will then drive the economic performance.

The literature review has revealed the green supplier development strategies that can be used by the manufacturing companies in Malaysia. It also allows us to understand how the strategies can help to improve firm environmental and economic performance.

3. Research Methodology

This study adopts quantitative method to understand the relationship between green supplier development strategy and firm performance. It focuses on the manufacturing companies in Kedah, Malaysia. The total population of companies is 10,859 (Businesslist, 2020). Based on Kerjcie and Morgan (1970), the sample size of this study is 370. A survey was conducted among the sample companies, which were selected using random sampling. Data were collected using a questionnaire that was developed based on the literature review. The questionnaire consists of three sections: demography, green supplier development strategy and firm performance. Green supplier development and firm performance were measured using 5-point Likert scale. The questionnaire was distributed through email. Companies were also contacted by phone to invite them to participate in the survey. Data gathered through the survey were analyzed using descriptive and correlation analysis.

4. Results and Discussion

Discussions of the results are divided into two parts, namely respondent demography, level of green supplier development practices and firm performance, and the relationship between the two variables. Overall, 58 questionnaire were returned from the survey conducted among manufacturing companies in Kedah. This makes the response rate to be about 15.68%.

Table 5: Result of reliability test

Factors	Cronbach's Alpha (N=58)	Items
Training for supplier	0.873	3
Information sharing	0.950	4
Evaluation and assessment on supplier	0.957	6
Good relationship	0.946	8
Environmental performance	0.959	8
Economic performance	0.966	5

A reliability analysis was conducted to test the internal consistency of the research instrument. Table 5 shows the results of the reliability analysis. The test revealed that the Cronbach's alpha value of all measurement factors for independent and dependent variables are above 0.80. This indicates that the reliability coefficient is good (Taber, 2018).

4.1 Demography of Respondents

Table 6: Result of reliability test

Item	Frequency	Percentage (%)
Job position		
Director	7	12.1
Operation Manager	18	31
General Manager	12	20.7
Marketing Manager	10	17.2
Purchasing Manager	5	8.6
Other	6	10.3
Years of working in company		
Less than 5 years	9	15.5
6 to 10 years	28	48.3
11 to 15 years	15	25.9
16 to 20 years	5	8.6
More than 20 years	1	1.7
Type of manufacturing sector		
Electronic	15	25.9
Furniture	6	10.3
Plastic and Rubber	8	13.8
Wood, Paper, and Printing	12	20.7
Textile	5	8.6
Food and Beverage	7	12.1
Other	5	8.6
Number of employees		
Less than 250	40	69
250 to 500	11	19
501 to 750	2	3.4
751 to 1000	2	3.4
Above 1000	3	5.2
Annual revenue (RM)		
Less than 25 million	25	43.1
25.1 million to 50 million	21	36.2
50.1 million to 75 million	7	12.1
75.1 million to 100 million	2	3.4
Above 100 million	3	5.2

Table 6 summarizes the demography of the respondents of this study. Based on the table, operations manager is the most common job position among the respondents with 31%. Most of the respondents, which is 48.3%, have been working for six to ten years in the sample companies. The working period of more than 20 years recorded the lowest percentage of 1.7%. About 30% of the respondents are from electronic sector, followed by wood, paper and printing sector with the recorded percentage of 20.7%. Meanwhile, both the textile and other sector recorded the same lowest percentage of 8.6%. Most of the companies employ less than 500 employees with the percentage of 88%. Three respondents reveal that their company have more than 1000 employees with the percentage of 5.2%. About 43.1% of the companies recorded annual revenue of less than 25 million. Only three companies (5.2%) had annual revenue of more than RM100 million. Based on this we can conclude that most of the respondents were from small and medium-sized enterprises (SMEs).

4.2 Level of Green Supplier Development Strategies and Firm Performance

Table 7 shows the results of descriptive analysis of the level of green supplier development strategies implementation among the companies. Based on the table, all strategies had high central tendency. Training for supplier has a mean score of 4.07. Information sharing has the highest mean score compared to other strategies, with mean value of 4.22. Then, evaluation and assessment on supplier had the lowest mean score of 3.93, and standard deviation is 0.96. Lastly, the total mean score for the good relationship with supplier is 4.00. Therefore, all the green supplier development strategies had high level of implementation among the manufacturing companies studied.

Table 7: Level of green supplier development strategy implementation

GSDS	Mean	Standard Deviation	Scale
Training for supplier	4.07	0.81	High
Information sharing	4.22	0.92	High
Evaluation and assessment on supplier	3.93	0.96	High
Good relationship	4.00	1.01	High

Table 8 shows the descriptive analysis for the level of firm performance. The results show that environmental performance has a mean score of 4.33, while economic performance has a mean score of 4.42.

Table 8: Summary for firm performance

Firm Performance	Mean	SD	Scale
Environmental performance	4.33	0.88	High
Reduce air pollution	4.28	0.87	High
Reduce effluent	4.24	0.86	High
Reduce solid waste	4.40	0.95	High
Reduce hazardous, harmful, toxic material	4.36	0.93	High
Reduce gas emission	4.38	0.83	High
Reduce water emission	4.29	0.92	High
Advanced waste treatment	4.31	0.90	High
Decrease the frequency for environmental accident	4.34	0.78	High
Economic performance	4.42	0.83	High
Reduce cost of purchased material	4.50	0.86	High
Reduce cost of energy consumption	4.40	0.86	High
Reduce cost of waste treatment	4.40	0.82	High
Reduce cost of waste discharge	4.43	0.82	High
Reduce cost of fine for environmental accident	4.38	0.81	High

Among the items used to measure firm environmental performance, the companies indicate that they were able to reduce solid waste most with mean score of 4.39. This is followed by reduction of emissions (4.38), hazardous, harmful and toxic material (4.36), and frequency of environmental accident (4.34). The results also show that reduction of effluent has the lowest mean score of 4.24. Overall, most of the manufacturing company in Malaysia had good environmental performance for their firm. In terms of economic performance, the companies indicate that they are able to reduce cost of purchased material most with mean score of 4.50. This is followed by, reduction of energy cost and waste treatment cost where both had mean score of 4.40, and cost of fine for environmental accident (mean score 4.38). Reduction of waste discharge cost had the lowest mean. Overall, most of the manufacturing company in Malaysia had good economic performance for their firm.

4.3 Relationship between Green Supplier Development Strategy and Firm Performance

Before correlation analysis can be conducted, a normality test was done to determine the type of analysis required. With the sample size of 58 companies, Kolmogorov-Smirnov was used to determine the normality of data distribution, as Shapiro-Wilk is not suitable for the sample size of below 50. The results show that data were not in normal distribution, thus Spearman correlation was used to identify the relationship between green supplier development strategy and firm performance. Table 9 shows the results of the correlation analysis.

Table 10: Correlation analysis for green supplier development strategies and firm performance

Item	TS	IS	EA	GR	EVP	ECP
Training for supplier (TS)	1.000	0.69**	0.77**	0.69**	0.63**	0.56**
Information sharing (IS)	0.69**	1.000	0.64**	0.67**	0.61**	0.54**
Evaluation and assessment on supplier (EA)	0.77**	0.64**	1.000	0.79**	0.62**	0.64**
Good relationship (GR)	0.69**	0.67**	0.79**	1.000	0.67**	0.74**
Environmental performance (EVP)	0.63**	0.61**	0.62**	0.67**	1.000	0.87**
Economic performance (ECP)	0.56**	0.54**	0.64**	0.74**	0.87**	1.000

** Correlation is significant at 0.001 level (2-tailed)

The correlation results indicate that all supplier development strategies have positive significant relationship with environmental performance and economic performance. Among the strategies, good relationship has the strongest relationship with environmental performance ($r=0.76$ at $p<0.01$). The strategy also has the strongest relationship with economic performance ($r=0.74$, $p<0.01$). Information sharing, on the other hand, has the weakest relationship with environment performance ($r=0.61$, $p<0.01$). Similar result was found for the relationship between the strategy and economic performance ($r=0.54$, $P<0.01$). The results indicate that green supplier development can improve firm environmental and economic performance.

Based on the descriptive, it was found that information sharing and training for supplier have the highest mean score among other variables. Both of the variables have positive relationship with the firm performance. Previous study also mentioned that information sharing is essential for company performance. According to Baihaqi & Sohal (2013), information sharing is important for companies as it allows them to coordinate the activities with other supply chain partners. This will also increase their efficiency in managing the flow of supplies or service. Besides, information sharing in term of environmental management will further improve not only the environment performance, but also the economic performance (Lai *et al.*, 2015). Through the sharing of knowledge on environmental friendly product with customers and suppliers, company will be able to have better planning on the production to achieve environmental goals at lower cost.

Furthermore, training for supplier has a positive impact to the company. According to Ağan *et al.*, (2016), firm that implemented the green supplier development tend to improve the suppliers performance and capability. Firm can improve their supplier's efficiency through helping them in solving the problems and reduce the negative impact on environment. Subsequently, firm will be able to improving their performance by having a good management on the company supply chain.

In addition, good relationship has showed a positive relationship with firm's economic performance in this research. According to Kosgei & Gitau (2016), relationship management between supply chain partners is crucial for the company supply chain management. Some of the investment between company and suppliers are high where corporate contractual governance might not be adequate. Accountability and trust among the supply chain partners are important to maintain a good relationship with each other.

5. Conclusion

This study aims to identify the relationship between supplier development strategy and firm performance. A descriptive analysis on the level of supplier development strategies implementation shows that information sharing and training for supplier have the highest mean score among the strategies studied. This could indicate that the companies perceived that information sharing and training for supplier are the most important in green supplier development practices. In terms of the firm performance, the analysis reveals that companies were able to improve their environmental and economic performance in the last three years of their operations. The mean scores show that both performances were high.

The correlation analyses indicate that all green supplier development strategies have positive relationships with environmental and economic performance. Good relationship has the highest relationship with firm performance, while information sharing has the weakest relationship. The results imply that maintaining a good relationship with supplier, information sharing, supplier training as well as supplier evaluation and assessment can help companies green their supply chain. Specifically, the practices can help companies to enhance their environmental and economic performance.

There are a few limitations in the study that can be addressed in future research. First, the sample size is small, which affect the generalizability of the findings. Furthermore, the sample was gathered among companies located in Kedah, therefore it does not represent the manufacturing industry in Malaysia. A larger sample from the manufacturing companies population in Malaysia can be gathered to increase the results' generalizability. Second, the data collected were cross-sectional. A longitudinal study can be conducted to provide a clearer view of how companies implement the green supplier development strategies and their impact on performance over time. Third, this study used a survey to gather data. A case study that gathers data through interviews and secondary sources could give richer data on the strategies and performance. Finally, this study only considers two dimensions of performance. Future studies could include other dimensions such as operational and social performance.

Understanding of green supplier development strategies is important to reduce the damage caused by manufacturing activities to the environment. There are some environmental challenges that need close attention. It includes global warming, carbon emissions, acid rain, and pollution that have adverse impact on the environment. Companies should work closely with their suppliers to reduce the impact of their activities. Therefore, selecting the best suppliers based on, for example, cost, quality, delivery, reliability and performance are no longer acceptable. The industries should also include environmental aspects in relation to the green performance of the candidate suppliers.

Acknowledgement

This research is part of Technology & Innovation Management Focus Group activities in developing student competencies. Special thanks to the Faculty of Technology Management and Business and UTHM in general.

References

- Ağan, Y., Kuzey, C., Acar, M. F., & Açıkgöz, A. (2016). The relationships between corporate social responsibility, environmental supplier development, and firm performance. *Journal of Cleaner Production*, *112*, 1872-1881.
- Akman, G. (2015). Evaluating suppliers to include green supplier development programs via fuzzy c-means and VIKOR methods. *Computers and Industrial Engineering*, *86*, 69-82. <https://doi.org/10.1016/j.cie.2014.10.013>
- Awasthi, A., & Kannan, G. (2016). Green supplier development program selection using NGT and VIKOR under fuzzy environment. *Computers and Industrial Engineering*, *91*, 100-108. <https://doi.org/10.1016/j.cie.2015.11.011>
- Bag, S., Gupta, S., & Telukdarie, A. (2018). Importance of innovation and flexibility in configuring supply network sustainability. *Benchmarking*, *25*(9), 3951-3985. <https://doi.org/10.1108/BIJ-06-2017-0132>
- Bai, C., Dhavale, D., & Sarkis, J. (2016). Complex investment decisions using rough set and fuzzy c-means: An example of investment in green supply chains. *European Journal of Operational Research*, *248*(2), 507-521. <https://doi.org/10.1016/j.ejor.2015.07.059>
- Bai, C., & Sarkis, J. (2010). Green supplier development: Analytical evaluation using rough set theory. *Journal of Cleaner Production*, *18*(12), 1200-1210. <https://doi.org/10.1016/j.jclepro.2010.01.016>
- Baihaqi, I., & Sohal, A. S. (2013). The impact of information sharing in supply chains on organisational performance: An empirical study. *Production Planning and Control*, *24*(8-9), 743-758. <https://doi.org/10.1080/09537287.2012.666865>
- Blome, C., Hollos, D., & Paulraj, A. (2014). Green procurement and green supplier development: Antecedents and effects on supplier performance. *International Journal of Production Research*, *52*(1), 32-49. <https://doi.org/10.1080/00207543.2013.825748>
- Businesslist. (2020). Retrieved June 4, 2020, from <https://www.businesslist.my/category/manufacturing>
- Dou, Y., Zhu, Q., & Sarkis, J. (2014). Evaluating green supplier development programs with a grey-analytical network process-based methodology. *European Journal of Operational Research*, *233*(2), 420-431. <https://doi.org/10.1016/j.ejor.2013.03.004>
- Fu, X., Zhu, Q., & Sarkis, J. (2012). Evaluating green supplier development programs at a telecommunications systems provider. *International Journal of Production Economics*, *140*(1), 357-367. <https://doi.org/10.1016/j.ijpe.2011.08.030>
- Geng, R., Mansouri, S. A., & Aktas, E. (2017). The relationship between green supply chain management and performance: A meta-analysis of empirical evidences in Asian emerging economies. *International Journal of Production Economics*, *183*, 245-258. <https://doi.org/10.1016/j.ijpe.2016.10.008>
- Green, K. W., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management*, *17*(3), 290-305. <https://doi.org/10.1108/13598541211227126>
- Kosgei, R. C., & Gitau, R. (2016). Effect of Supplier Relationship Management on Organizational Performance : a Case Study of Kenya Airways Limited. *International Academic Journal of Procurement and Supply Chain Management (IAJPSCM)*, *2*(2), 134-148. Retrieved from http://www.iajournals.org/articles/iajp scm_v2_i2_134_148.pdfhttp://www.iajournals.org/articles/iajp scm_v2_i2_134_148.pdf^{0A}http://www.iajournals.org/articles/iajp scm_v2_i2_134_148.pdf^{0A}Citation:
- Krejcie, R. V., & Morgan, D. (1970). Small Sample Techniques. *The NEA Research Bulletin*, *39*, 99.
- Lai, K. H., Wong, C. W. Y., & Lam, J. S. L. (2015). Sharing environmental management information with supply chain partners and the performance contingencies on environmental munificence. *International Journal of Production Economics*, *164*, 445-453. <https://doi.org/10.1016/j.ijpe.2014.12.009>
- Mudgal, R. K. (2010). Modelling the barriers of green supply chain practices. *Int. J. Logistics Systems and Management*, *7*(1). Retrieved from <http://www.inderscience.com/link.php?id=13460>
- Petljak, K., Zulauf, K., Štulec, I., Seuring, S., & Wagner, R. (2018). Green supply chain management in food retailing: survey-based evidence in Croatia. *Supply Chain Management*, *23*(1), 1-15. <https://doi.org/10.1108/SCM-04-2017-0133>
- Sahu, N. K., Datta, S., & Mahapatra, S. S. (2014). Green supplier appraisalment in fuzzy environment.

- Benchmarking*, 21(3), 412–429. <https://doi.org/10.1108/BIJ-06-2012-0042>
- Shen, L., Olfat, L., Govindan, K., Khodaverdi, R., & Diabat, A. (2013). A fuzzy multi criteria approach for evaluating green supplier's performance in green supply chain with linguistic preferences. *Resources, Conservation and Recycling*, 74, 170–179. <https://doi.org/10.1016/j.resconrec.2012.09.006>
- Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, 48(6), 1273–1296. <https://doi.org/10.1007/s11165-016-9602-2>
- Thakker, S. V., & Rane, S. B. (2018). Implementation of green supplier development process model in Indian automobile industry. *Management of Environmental Quality: An International Journal*, 29(5), 938–960. <https://doi.org/10.1108/MEQ-03-2018-0052>
- Xu, Y., & Peng, Q. (2018). An Empirical Study on the Relationship between Green Supplier Development and Firm Performance. *American Journal of Industrial and Business Management*, 08(04), 930–945. <https://doi.org/10.4236/ajibm.2018.84064>
- Yu, Q., & Hou, F. (2016). An approach for green supplier selection in the automobile manufacturing industry. *Kybernetes*, 45(4), 571–588. <https://doi.org/10.1108/K-01-2015-0034>