International Journal of Sustainable Development and Planning
Vol. 18, No. 11, November, 2023, pp. 3381-3387
Journal homepage: http://iieta.org/journals/ijsdp

The Impact of Green Supply Chain Practices Towards Operational Performances Among SMEs in Penang, Malaysia

Bak Aun Teoh[1*], Ameer Farhan Mohd Arzaman[2], Boon Cheong Chew[1], Mohd Syafiq Abd Aziz[3], Massila Kamalrudin[4], Jia Le Germaine Chee[5]

[1] Centre of Technopreneurship Development (CTeD), Fakulti Pengurusan Teknologi Dan Teknousahawanan (FPTT), Universiti Teknikal Malaysia Melaka (UTeM), Ayer Keroh 75450, Malaysia
[2] School of Business Management, Universiti Utara Malaysia (UUM), Sintok 06010, Malaysia
[3] Tribology Group, Department of Mechanical Engineering, Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom
[4] Fakulti Teknologi Maklumat dan Komunikasi (FTMK), Universiti Teknikal Malaysia Melaka (UTeM), Durian Tunggal 76100, Malaysia
[5] School of Maritime Business & Logistics, Peninsula College Malaysia, Simpang Ampat 14110, Malaysia

Corresponding Author Email: teohba@utem.edu.my

https://doi.org/10.18280/ijsdp.181104

Received: 22 May 2023
Revised: 24 September 2023
Accepted: 1 October 2023
Available online: 30 November 2023

Keywords:
green supply chain practices, operational performance, SMEs, logistics

ABSTRACT

This research aimed to examine the relationship between green supply chain practices and operational performance among small and medium enterprises (SMEs) in Penang, Malaysia. The practices of green supply chain in achieving operational performance have been a priority concern in Malaysia. Nevertheless, the concept of green supply chain practices adoption is in embryonic phase. The study used multiple regression analysis to investigate the green supply chain (GSC) practices and operational performance variables. The 120 self-administered questionnaires were randomly distributed among SMEs in Penang, Malaysia, with 59 responses collected. Theoretically, the research ascertained the positive relationship between GSC practices and operational performance variables. The findings align with the underlying theory of dynamic capabilities, which conceptualizes GSC practices and strategies to sustain operational performance within SMEs. In short, the findings of this research provided the research implications and recommendations to the researchers, industrial practitioners and policymakers who are having interest in these GSC practices and operational performance. This research served as a guideline for companies that tend to implement these GSC practices for improving its operational performance. The research revealed that both eco-design and packaging and reverse logistics practices are found to be significantly related to operational performance, but both green procurement and investment recovery practices found to be not significantly related to operational performance. There are gaps in the literature, hence, further research should be carried out on supply chain practices and operational performance. There are no fixed formulas for sustaining operational performance that match all conditions in Penang SMEs.

1. INTRODUCTION

Contemporary business practices have shown that companies can benefit from a better public image, cost savings and reduced environmental liabilities by introducing green supply chain (GSC) practices and components into the company's supply chain [1]. Hence, many SMEs have started to adopt GSC practices to respond to the market demand with green products and services such as reusable organic cotton clothes and footwear, straws and utensils and eco-cleaning products [2]. For instance, IKEA is one of the companies that have adopted green practices. IKEA products are manufactured with more sustainable resources such as wood and cotton that are either recycled or with lesser chemical fertilizer consumption [3]. To maintain balanced operational performance, it is vitally important for business organizations to face regulatory, public, and competitive pressures [4]. The GSC practices also act as a mechanism that promotes supply chain efficiency and improves operational performance. It is also known as a new method to reach better organizational performance as green innovation and management are likely one of the main performance indicators for most industries in the days ahead. The GSC practices include green procurement, investment recovery, eco-design and packaging, and reverse logistics. Adopting green in any phase of a supply chain helps to eliminate the trade-offs between operational performance such as increased profits and market share and cost reduction [5].

Although global industrialization has been contributory in the world's economic growth, it has improved living standards by improving productivity and catering for mass production [6]. However, it has also increased the material and energy consumption which has eventually led to various environmental concerns. This has led to the generation of

roughly 1.17kg of solid waste daily, approximately 10.5% being recycled while the remaining was disposed of in landfills [7]. This waste generation have created the sense of urgency to adopt GSC practices among business operations, especially for small and medium enterprises (SMEs). Industrialization increases energy and material consumption, which leads to negative consequences for the environment and resources. Manufacturing firms, on the other hand, emit more emissions than other industries during the manufacturing process in order to meet customer needs and desires. Consequently, industrial enterprises must pay more attention to its impact on the environment. The manufacturing industries are now being blamed for contributing to global warming through generating waste, disrupting the ecosystem, and depleting natural resources due to their widespread ignorance [8]. The Earth's global average surface temperature in 2021 was tied for the 6th warmest year in continued trend [9]. The global temperatures in 2021 were 0.85 degree Celsius higher compared to the norm for NASA's baseline period as indicated in Figure 1.

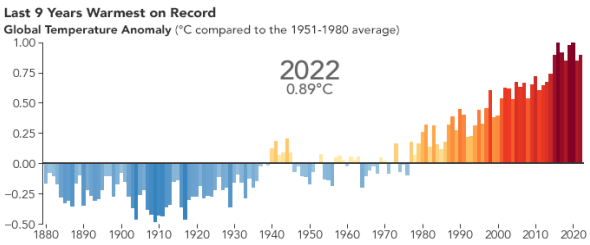


Figure 1. Global temperatures from year 1880 to 2020
Source: Hansen et al. [9]

Nonetheless, companies are becoming more conscious of their operation procedures and how they impact the environment. GSC practices have grown in popularity among Malaysian enterprises over the years, though not as much as it has in developed countries. To further illustrate, electronic devices exporters to the European Union are required to disclose the percentage of reused or recycled components in their products. While in Sweden, Taiwan and the United Arab Emirates, companies must also comply with hazardous material disclosure requirements for electronic appliances. When compared to other developed countries, Malaysian-based corporations have the lowest engagement in GSC efforts [10]. Putting into domestic context, Malaysian GSC practices are highly influenced by the technological, organizational, and environmental factors. While implementation cost has often been considered a significant barrier to technology adoption, some researchers have contended that cost, to make cost-effective production in an organization, can serve as driving determinants for organizations in embracing innovative technologies [11].

Due to GSC practices are relatively embryonic in Malaysia, many companies are still not incorporating GSC practices into their operations. Furthermore, the increased competitiveness and the awareness of green initiatives have triggered companies to be socially and ethically responsible in their supply chain [10]. The concept of competitiveness can be defined in a variety of ways. Competitive advantage is using cost and differentiation for creating uniqueness that stands out from the competitors [12]. To be competitive, GSC practices are being utilized as a mechanism to promote cost leadership and differentiation strategies across the supply chain.

Besides, theoretically, since dynamic capabilities are linked to "many schools of thought" [7], limited research had defined dynamic capabilities according to the relationships between GSC practices and operational performance. Penang is an Asian hub for several industries, including electronics, manufacturing, and services, thus, many of these businesses have recognized the importance of incorporating green supply chain practices and sustainability into their supply chain operations [9]. Hence, the appropriateness of the dynamic capability approach in this study will be demonstrated in the following discussion. In short, an organization should establish the relation between internal capabilities, resources, and strategies (such as GSC practices) to achieve operational performance.

2. LITERATURE REVIEW

With the increasing competitiveness in supply chains and the changing demands of customers, it is crucial for companies to explore and adopt practices that offer a competitive advantage, leading to greater operational performance among the supply chain players [13]. Operational performance refers to the impact of green initiatives on the company's operations; measured by the dimensions of product quality, cost reductions and flexibility [14].

Purchasing more eco-friendly materials helps the company to focus on producing quality products, while supplier collaborations help with enhanced delivery performance [15]. Remanufacturing is a process where certain parts of goods are repaired, reused, refurbished, and replaced. By remanufacturing products, costs are lower, and products are launched with better time-to-market and warranties; and leads to higher revenues, reduced resources and energy consumptions and better product quality [16]. Cost reductions are the most frequently mentioned operational impact of green initiatives. Green initiatives can reduce costs by guaranteed disposal, economies of scale, greater access to secondary markets, regulatory compliance, and reduced transportation costs [17]. Green initiatives such as remanufacturing (reverse logistics) help in improving product quality by returning in new circumstances. Flexibility is significantly increasing as it helps companies to respond to challenges faster and more cost-effectively such as globalization, technological development, innovations, and ongoing economic uncertainties [18]. It is because supply chain's flexibility relies on the effectiveness and resource reservation for reallocating unnecessary resources [19].

Green supply chain (GSC) practices help in improving the overall performance of a company. First, green initiatives developed upstream, such as green procurement (GP) and eco-design and packaging (EDP), involve close interaction with vendors on environmental issues. Supplier integration means working with key suppliers to coordinate and share information that gives the firm an overview of their processes. These suppliers help in effective planning and forecasting, developing eco-design and product recyclability [20]. Then, green initiatives developed downstream including customer collaboration, reverse logistics and eco-packaging in which these initiatives integrate environmental concerns into information and materials flows between firms and their downstream delivery partners. Customer integration means working with key customers to exchange information that provides the firm with exploring market opportunities strategically and a more effective response to customers' demands for green products [20]. The purchasing role is the

initial stage in the value chain, and its accomplishment will be predetermined by the organization's ability to integrate procurement activities and the efforts and goals towards the environment. Thus, GP is an important element in GSC practices [21]. GP is defined as environmentally oriented purchasing of materials and products that meet the environmental concerns such as waste reduction, materials substitution and the reuse and recycle advocacy [22]. To achieve a company's environmental objectives, choosing the right supplier is crucial. The entire process must be managed by implementing a strategic supplier collaboration once a suitable supplier is chosen. Hence, GP is important towards operational performance [23].

Green packaging is defined as any packaging that uses safer and more reliable materials to produce and is recyclable and reusable to meet market requirements as in performance and costs [24]. Green packaging such as excessive packaging elimination, biodegradability, polystyrene reduction, and simple packaging [25], which is intertwined with other value chain components and will directly impact the environment. Product eco-design considers the product design performance in the context of environmental and safety impact over a product's life cycle. Eco-design means the process of designing environmental-friendly products by using materials or procedures that have lesser negative environmental impact. For instance, products with eco-design such as biodegradable furniture, reusable organic cotton clothes and footwear [26]. Thus, eco-design integrates environmental factors into the design process, considering complete product flow throughout its supply chain. This is critical because most environmental issues resulting from manufacturing, consumption and disposal of the products are the aftermath of decisions made during the design phase. Decisions include raw materials, supplies, product function and manufacturing procedures [26]. EDP helps in encouraging company innovations, enhancing brand positioning and operational performance and reducing environmental impacts [27].

Reverse logistics (RL) is a logistics function that focuses on the product flow from customers to suppliers in a reverse direction [28]. It is considered as one of the important GSC components since it helps to reduce waste generated by processing returned products through a range of disposal options [29]. Common disposal options of RL include reuse, remanufacturing, repair, recycling, and disposal [29]. Good RL results in sustainable growth and provides a competitive advantage by increasing revenues, lowering costs, and enhancing customer satisfaction [30]. RL can recapture value from returned products and then prolong the lifecycle of product, instead of acquiring additional raw materials and labor and time wastage. Furthermore, RL helps in product development by gathering customers feedback and understanding the intentions for product returns [3]. Conclusively, it provides a post-operational activity to companies where they can focus on value-adding to the product which improves their operational performance and minimizes the negative environmental impact simultaneously [6].

The investment recovery (IR) is one of the green initiatives where excess or the used materials and inventories are resold [31-46]. IR is another most frequently mentioned dimension in the GSC literature. Companies use IR as a strategic component to redeploy, resell, recycle and other related approaches to recover more value from materials and products [23]. It is one unique approach for generating profits by selling worthless assets, reducing space and storage requirements, and relocating idle assets from other companies to avoid overbuying. It is a process that benefits organization and society operationally and environmentally [23]. For instance, many companies in the United States have started selling excess and unwanted products through online auctions. Consequently, through review of literature, there are numerous probable GSC practices measures.

The theory of dynamic capabilities underpinned the GSC practices and operational performance under competitive market environment [25]. Since the theory of dynamic capabilities exists as an extended version of the resource-based view (RBV), the assumptions used in RBV also applicable to dynamic capabilities [5, 22] as they share similarities like creation of capabilities and resources. Dynamic capabilities emphasize resource regeneration through configuration of the resources into new combinations of effective capabilities whereas RBV stresses on resource selections and combinations [25]. In general, dynamic capabilities and RBV differ in three characteristics:

(1) competitive advantages for RBV are attained in equilibrium, while dynamic capabilities are achieved in disequilibrium based on the study of [41].

(2) RBV accentuated on the best method of utilizing organization's resources, whilst dynamic capabilities emphasized on the best alternative to integrate, reconfigure resources and competitive advantages reposition [13].

(3) RBV is static in nature and insensible to the respond of market changes, while dynamic capabilities (as the name implies) are dynamic in nature, responding to environmental alteration [19, 41].

Managers face challenges in their mission of integrating dynamic capabilities to sustain competitive advantages, as they are required to make decisions by innovation of present operational capability to a better one that matches the changing market demand [25]. Thus, the research question in this study is as follow: - "Is there a significant relationship between the impact of these green supply chain management practices towards operational performance among the SMEs in Penang?"

3. RESULTS

Quantitative research is used to conduct this research, where small medium-sized enterprises (SMEs) in Penang were selected. The unit of analysis for this study is organization. The SME's executives or top management, manager, and supervisor are the appropriate candidates for the research as they are able to give a complete comprehension of GSC practices, especially in terms of their impact on operational performance. They are the key person to their organizations in the whole strategies, policies plans and implementation of the company. Likewise, the primary source data were mainly obtained in the research. Next, the questionnaires were distributed, and the primary data were obtained for further analysis. The 66,921 Penang-based SMEs were chosen as the population of this research. The minimum sample size of 60 was determined using G*Power analysis. 50 percent of response rate is considered sufficient in the social science surveys context to represent the behavioral of the population [4]. Hence, the number of questionnaires distributed will be doubled by 120 respondents [4]. A systematic sampling is employed to select the Penang-based SMES based on the list of Federation of Malaysian Manufacturers (FMM) directory.

Next, the questionnaires will then be emailed to the selected SMEs and the participants were given four weeks to respond and complete the survey. From the 120 questionnaires emailed, 59 responses (49.1 per cent) were collected. All 59 questionnaires were then used for further analysis.

3.1 Measurement

This research selects GSC practices (green procurement, investment recovery, eco-design and packaging, and reverse logistics) typology to study the Penang-based SMEs' operational performance (product quality, cost reductions and flexibility) as these variables has been adopted in previous studies as the variables are easily understood by most respondents [15, 17]. The respondents will be required to respond based on the five-point ordinal Likert scale in the range of "1" denotes "Strongly Disagree" to "5" denotes "Strongly Agree".

3.2 Content validity

Table 1. Content validity indices for green supply chain practices and operational performance's measurement

	Experts			
	1	**2**	**3**	**4**
Green supply chain practices:				
Item being rated "not/ somewhat relevant"	3	2	4	2
Item being rated "quite/ highly relevant"	19	20	18	20
CVI	0.864	0.909	0.818	0.909
Operational performance:				
Item being rated "not/ somewhat relevant"	1	0	0	2
Item being rated "quite/ highly relevant"	5	6	6	4
CVI	0.833	1.000	1.000	0.667

Note(s): CVI=content validity indices
(1=non-relevant, 2=somewhat relevant, 3=quite relevant, 4= highly relevant)

Content validity was conducted in determining the appropriateness of construct items in measurement instruments [10]. This research obtained both content and face validity through the adoption of the indicators from reliable sources from past literatures. Next, the items were pretested by four senior academics experts and practitioners in validating the content of questionnaires. The four candidates were provided with the materials that encompassed the conceptualized definition of the dimensions, items and ratings, participant's position, and acknowledgement [27]. The four experts were then elasked to respond on the relevancies of the construct based on four-point ordinal scale that ranging from "1" denotes "not relevant", "2" denotes "somewhat relevant", "3" denotes "quite relevant", "4" denotes "highly relevant". In congruence to Yook et al. [21]'s proposal, a four-point ordinal scale was adopted in eliminating uncertain and neutral ratings. The GSC practices and operational performance construct's content validity indices (CVI) were generated with all the value obtained in Table 1 greater than 0.70 that indicates a high acceptance level of CVI [28]. Hence, the four experts had ascertained the highly satisfied CVI level of green supply chain practices and operational performance's measurement.

4. DISCUSSION

4.1 Reliability analysis

Reliability analysis was performed to measure whether the utilized items in each variable are reliable enough to provide consistent results. Hence, Cronbach's Alpha test was used. Generally, coefficients that range above 0.6 are acceptable [10]. Cronbach's Alpha results were shown after performing factor analysis for green procurement, investment recovery, eco-design and packaging, reverse logistics, and operational performance. The coefficient for all variables in this research exceeded 0.6 as depicted in Table 2 which represented that all items utilized have adequate reliability. Consequently, both validity and reliability of the items, as tested by the factor analysis and reliability test, provide a useful foundation for further hypothesis evaluation.

Table 2. Reliability analysis

Variables	Number of Items Utilized	Cronbach's Alpha
GP	5	0.676
IR	5	0.659
EDP	6	0.785
RL	6	0.843
OP	6	0.760

4.2 Pearson correlation analysis

Pearson Correlation Analysis identifies the relationship between independent variables and dependent variables. Generally, the correlation is strong if the absolute value or r is above 0.75 [45]. Table 3 depicted the presence of the correlation between the independent variables and dependent variables. The eco-design and packaging variable showed moderate relationship with operational performance (r = 0.506), trailed by green procurement (r = 0.469) and reverse logistics (r = 0.461). Nonetheless, investment recovery has the weakest relationship with operational performance (r = 0.313). Thus, the correlation between all independent variables with operational performance is significant at 0.01 level.

Table 3. Pearson correlation analysis

	OP
GP	0.469**
IR	0.313**
EDP	0.506**
RL	0.461**

Note: p**< 0.01 (one-tailed)

4.3 Multiple regression analysis

To test the relationship between independent variables and dependent variables in this study, multiple regression analysis was performed to estimate the value of dependent variables with established independent variables. This analysis was also used for hypothesis testing. The R^2 value is showing that the GSC practices yield 40.7 percent variations in operational performance. The model has a good fit with the F-value= 9.255 obtained at p value < 0.001. Table 4 depicts that there are two variables that have a positive relationship with the operational performance of SMEs in Penang. If p value is more than 0.05, hypothesis is not supported [31].

Consequently, EDP (β = 0.339, t value = 2.731, p value < 0.05) and RL (β = 0.281, t value = 2.291, p value < 0.05), resulting H3 and H4 are supported. Meanwhile, there are no significant relationships for GP (β = 0,291, t value = 2.459, p value > 0.05) and IR (β = -0.097, t value = 0.740, p value > 0.05) with operational performance. Thus, H1 and H2 are not supported in this study. Thus, the findings are aligned with the past literatures [23, 26, 47].

Table 4. Regression analysis for operational performance

Hypotheses	Standardized Beta (β)	*t* value	*p* value	Decision
H1: GP→OP	0.291	2.459	0.085	Not Supported
H2: IR→OP	-0.097	-0.740	0.231	Not Supported
H3: EDP→OP	0.339	2.731	0.0045**	Supported
H4: RL→OP	0.281	2.291	0.013**	Supported

Note: p**<0.01 (one-tailed)

This study is not exempted from any limitations, and it is not a section for undermining the results, in fact, it shows that the study is aware of the limitations. Firstly, the sample selection only focused on the small and medium enterprises in one of the Malaysian states in Penang. Consequently, the findings of this study are limited to only Penang SMEs and do not fully represent the entire population of the Malaysian SMEs. Moreover, the sample size is small as the unit of analysis in this research is one SME in Penang equivalent to one unit. Furthermore, the generalizability of this study is limited as only one representative from the company can answer the questionnaire and it is also time intensive as appointments need to be made in advance. This study required respondents who only held high positions (e.g., executives or top management, manager, and supervisor) in the company to complete the questionnaires and normal staff are not required to answer the questionnaire. Thus, the response rate is low.

In terms of actionable implications, industrial practitioners can facilitate their technological innovation through comprehensive understanding in various potential green supply chain practices to be implemented in their businesses. It is to reduce negative impacts to the environment and improve operational performance. It provides significant implication to industry practitioners attempt to develop a cost-effective, product and process-oriented system in achieving a better operational performance with the implementation of green supply chain practices. Lastly, the results also yield practical implication to policymakers. It shows that several GSC practices are positively related to operational performance among SMEs in Penang. It provides the policymakers with a thorough grasp of the benefits for implementing GSC practices. Environmental issues have become one of the pressing issues in Malaysia, thus, the policymakers should take the initiative to develop relevant green supply chain regulations and guidelines as an integral approach for Penang SMEs.

5. CONCLUSIONS

The paper is novel research that revealed significant implications for the research communities on the impact of green supply chain management practices including green procurement, investment recovery, eco-design and packaging, and reverse logistics towards the operational performance. The findings have significant practical implications, particularly for industrial practitioners, policymakers, and managers. Practitioners should realize the importance of the green supply chain management practices and be more responsive in adopting these practices into their management. Products with green procurement, eco-design and packaging, and reverse logistics are key components of the green supply chain, which should be implemented by companies to enhance operational performance. Adopting a green supply chain is not only beneficial for the environment but also offers a range of practical advantages for businesses, including cost savings, improved reputation, and long-term sustainability. Hence, it requires commitment, investment, and a holistic approach that encompasses the entire supply chain network. Then, the analysis in each category acts as a guideline to implement green supply chain practices in the future. The result also enables the practitioners to examine their current supply chain status in terms of green procurement, investment recovery, eco-design, and packaging and reverse logistics by using the prescribed model.

The main purpose of this study is to examine the impact of green supply chain management practices towards the operational performance among the SMEs in Penang. However, there are limited research conducted on the topic as the conception of green initiatives is yet relatively new and most Malaysian companies have not implemented it. Also, this study is unable to get in-depth understanding as only survey questionnaires were used. Thus, the operational performance level could not be measured accurately based on their experience in reality with implemented green initiatives in their company. It is because all designed items in the questionnaire are scale-type questions which caused the respondents to not further explain their perspectives. Besides, it restricted the findings to be compared with other data sources by using the questionnaire as the only data source. Lastly, there is a limitation in scope as only four green supply chain management practices were proposed.

Future research can expand the sample selection to other Malaysian states. This enables the researchers to obtain more responses and be able to further examine how green supply chain management practices impact operational performance among Malaysian companies in a bigger context with the considerations of different company size and industry. Moreover, future study may also use qualitative data collection methods by having interviews with experts to obtain in-depth understanding on the related research topic. Researchers may also conduct both quantitative and qualitative data collection methods, it allows the researchers to receive different perspectives and be able to compare the data collected. The researcher can also design the questionnaire items with a combination of open-ended questions and rating-scale questions. This enables the researchers to have a more in-depth understanding compared to only scale type questionnaires. Besides, further studies can include other potential green supply chain practices such as reducing energy consumption, green supply chain collaboration, green manufacturing, green distribution, and green transportation. This allows the researchers to further examine how other potential green practices could influence the operational performance and provide a comprehensive study to the readers. Lastly, it is encouraged that the researchers have adequate time to conduct

the research, to achieve a higher response rate and better data analysis results. This research discovered important GSC practices among the SMEs in Penang, Malaysia. Within all four GSC practices, only eco-design and packaging and reverse logistics practices are significantly positive with operational performance. The study seeks to analyse the impact of green supply chain management practices towards the operational performance among SMEs in Penang. The findings of this research can be used to have a more comprehensive understanding of how green supply chain management strategies can help companies to improve operational performance. Moreover, the findings of this research also aim to increase the awareness level for Malaysian companies to implement these green initiatives by realizing the benefits and importance. However, different companies' characteristics could be one significant challenge for the implementation of green practices.

ACKNOWLEDGMENT

The authors wish to thank all the respective respondents during the interviews and provide data throughout this study conducted. In addition, the authors acknowledge the support given by Universiti Teknikal Malaysia Melaka (UTeM) and Universiti Utara Malaysia (UUM) for the financial support and facilities provided in completing this research. We will welcome any collaboration for this kind of research with an open arm.

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