

## The influence of environmental actions and customer activities in GSCM on operational performance

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### ABSTRACT

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This paper aims to explore the level of manufacturing performance, environmental actions and customer activities in implementing green supply chain initiatives. Besides, the relationship between environmental actions and customer activities towards manufacturing performance also been investigated. For this purposes, the data was collected using questionnaire-based survey among Malaysian manufacturing firms. Using the descriptive and correlation test, the data was analyzed. From the results, it is showing that the manufacturing performance through the implementation of green supply chain management has a positive relationship to environmental action and customer activities.

#### Keywords:

Manufacturing performance, Green supply chain management, Environment actions, Customer activities

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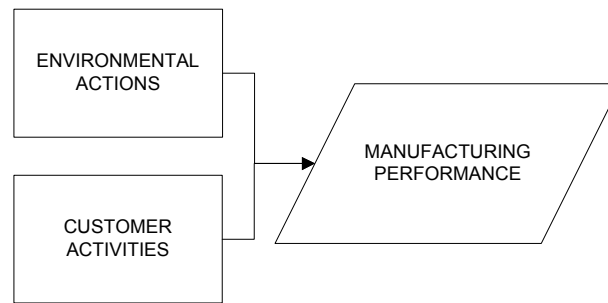
## 1. Introduction

Nowadays, manufacturers are actively focus in optimizing the use of resources in order to achieve the aspects of environmental sustainability practices, primarily in reducing the adverse impact to the environment. In line with the concept of sustainability in manufacturing, the use of green technology has been widely accepted and implemented by most of manufacturing firms through high focus in Green Supply Chain Management (GSCM) [1]. The thought of green supply chain management comes from the increasing pressure on the enterprises to protect the environment [2]. According to [3], the assessment of GSCM has a close linkage with Manufacturing Performance (MP). This is because the MP has been accepted as an important management mechanism as an effective criteria in achieving the objectives that sets by manufacturing firms [3]. Performance measurement emphasizes the link

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between internal (operations) and external (operations) performance, in terms of general operational dimensions as cost, speed, quality, dependability and flexibility, which customers value [4]. Through the focus on Environmental Actions (EA) and Customer Activities (CA), the level of MP can be strengthening. As a results, manufacturing firms able to improve their operational activities, primarily when involving with the process in decision making, and in enhancing the accountability for overall operational performance [5]. Realizing on the influence of EA and CA on MP, this study is attempted to investigate how EA and CA had correlated to MP. This was based on the study framework as shown in Fig. 1.



**Fig. 1.** Relationship between environmental action and customer activities with manufacturing performance

## 2. Research method

For the analysis purposes, the data was collected using a questionnaire based survey. According to [6], questionnaires are one of the most widely used means of collecting data, and therefore many novice researchers in business and management and other areas of the social sciences associate research with questionnaires. The structure of the questionnaire consists of seven statements in assessing the MP, 13 statements that related with CA, and 21 statements related to EA based on cross references from 1992 to 2010 review of GSCM. In order to ensure the data is reliable for analysis, the respondent is requested to give the score for each statement using four Likert's scale (1= very poor, 2= poor, 3 = good and 4= very good). The justification for using a four-point Likert scale was that if we had used the more popular five-point scale or any other odd number of points in the scale, there might have been a tendency of having most negative responses loading heavily on the median level, the center point of the scale [7].

## 3. Result and discussion

From the descriptive analysis, the demographic data shows that over 60% of respondents are from top management (6.78% - Chief Executive Officer / Director / Managing Director, 11.86% Manager, 47.46% - General Manager / Assistant Manager at various levels). According to [3], a person from the managerial level can provide a more reliable information on the current performance of the manufacturing firms. . This including in setting the internal improvement program and activities by the management, such as GSCM [8]. Moreover, the data is much valuable, particularly in getting the information that relates to the implementation of GSCM from the perspectives of the top managerial level. Other than that, the data also shows that 41.3% of respondents are from electrical and electronic engineering (EE) company, followed 9,5% from mechanical engineering (ME) and manufacture of motor vehicle (MMV). The remaining respondents are from the manufacturing firms that produces other transport equipment.

### 3.1. Level of Manufacturing Performance

The performance measurement is a part of fundamental strategies that required by the management of manufacturing forms in making the strategic decisions [9]; [10] Through the performance measurement, management able to set the necessary action to increase the competition, and become more competitive in implementing the GSCM [11,12]. According to [13,14], the implementation of GSCM has been proved in improving the operational performance through the coordination between all the core business activities. Moreover, GSCM has been used as a benchmark in increasing the competition in a global manufacturing environment. In this study, seven MP criteria were assessed. It consists of a lead time reduction (MP1), reduction of through-put time (MP2), minimizing the work in progress (MP3), reduction of manufacturing cost (MP4), improving the product quality (MP5), improving the utilization of machines (MP6), and improving the flexibility of operations (MP7).

Figure 2 shows the mean score of all seven criteria for MP that assessed from the study population. These criteria's are arranged and ranked in accordance from the highest mean score value to the lowest mean score value. From Fig. 2, the highest MP criteria is MP5 (improving the product quality) with the mean score value of 3.25 out of 4. This was followed by MP1 (lead time reduction), MP2 (reduction of through-put time) and MP3 (minimizing the work in progress) have scored the same mean score value of 3.10 out of 4. Meanwhile, MP4 (reduction of manufacturing cost), MP6 (improving the utilization of machines) and MP7 (improving the flexibility of operations) have been given the lowest rank with mean score value of 3.06, 3.02, and 2.98 out of 4, respectively. The results obtained is similar with the study by [15], indicating that the MP has a positive influenced by the GSCM practices.

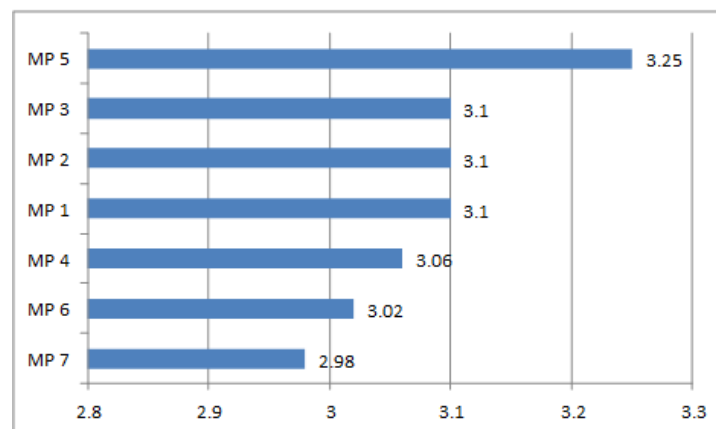


Fig. 2. Mean score for Manufacturing Performance

### 3.2. Level of customer activities

Based on Fig. 3, ensuring the customer complaints are properly addressed (CR6) is ranked with the highest mean score value of 3.46 out of 4. This is similar with the study by [16] that showing the focus in dealing with the customer needs and complaints, has become a vital success factor in implementing the GSCM by manufacturing firms. This was followed by CR1 (the identification of customer needs and focus) with the mean score value of 3.52 out of 4. This is not surprising because this criteria is important, mainly to support the goal of Quality Management (QM) and Supply Chain Management (SCM) in fulfilling the customer requirement that related to quality, cost, time of

delivery, and flexibility in operations [17]. SCM seeks to synchronize an organization's functions and those of its suppliers to match the flow of materials, services, and information with the customer demand [18]. Meanwhile, the activity in defining the production and operations procedures to ensure greater efficiency (CR2) is ranked with the mean score of 3.44 out of 4. This activity is closely related to how manufacturing firms respond to environmental legislation. As suggested by [19], some of the activities may include the implementation of standardized environmental management systems (in particular ISO 14001), life cycle assessments, environmental labelling of products, carbon disclosure projects, and sustainability reporting schemes. As for top management commitment (CR13), the mean score result is 3.43 out of 4. This showing that in Malaysia, the role of top management in manufacturing firms is important. It is necessary because only the top management can decide the risk that should be taken, and how to respond actively to any issues occurs in GSCM practices [20].

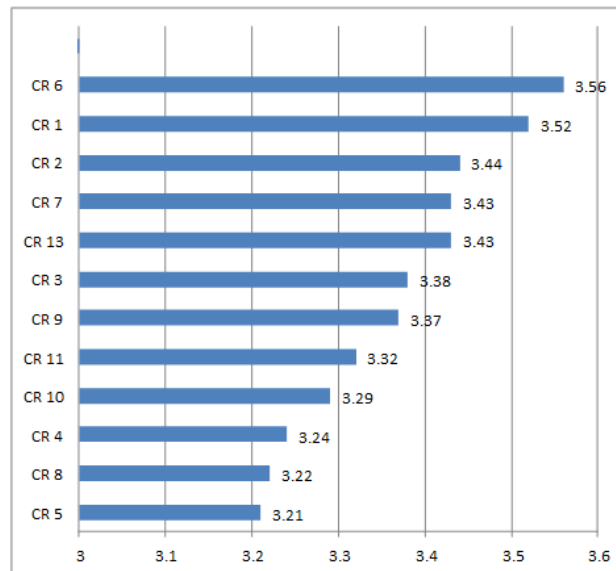


Fig. 3. Mean score for Customer Activities

### 3.3. Level of Environmental Action

Figure 4 shows the mean scores value of EA in population studied that related to GSCM practices. According to [21], the ability to control and use environmental friendly materials are identified as the most important elements in GSCM practices, particularly by manufacturing firms. According to [22] have stated that the readiness to use the environmentally friendly materials is closely related with the social responsibility and commitment by manufacturing firms to the environmental preservation. This eventually provide reassurance to the implementation of green production process, primarily in reducing the negative effects on the environment [23]. Besides, [24] stated that the focus in increasing the use of environmental material will reduce the customer prejudice with the final product or service.

As in Fig. 4, 14 out of 21 statements are accepted as the most practical elements in implementing GSCM with the mean score value above 3.00 out of 4. The highest ranks of GSCM practices is EA 1 (use environmentally friendly raw materials) with the mean score value of 3.47. This is not surprising because the environmentally materials is proven to be useful in environment conservation, mainly in producing an environmentally product as demand by customers. According to [7], most of manufacturing organizations in South East Asia has increase their focus in greening practices that

inbound the logistics function by using environmentally-friendly raw materials, reforming the greening production to cleaner production, as well as increasing the prevention of pollution practices at its source's. Meanwhile, the remaining 7 statements are ranked by the respondents with the mean score value lower than 3 out of 4. However, all these 7 statements are still perceived to be important in implementing the GSCM practices.

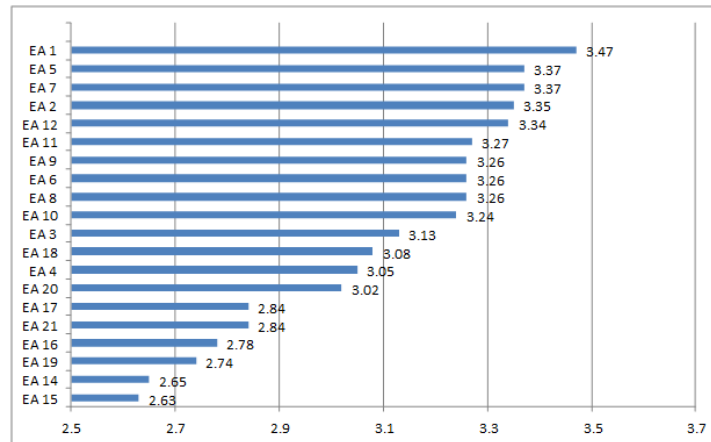


Fig. 4. Mean Score for Environmental Actions

### 3.2. Correlation test

In investigating the influence of CA and EA towards MP, Spearman correlation tests are conducted. The test results are recorded in Table 1. From a total of 147 matrices of relationship between MP and EA, there are 7.5% of matrices of relationship produce a moderate positive relationship with the MP. . Meanwhile, four matrices of relationship found to ne not significant with the MP, Namely (EA17 - MP1, EA14 - MP6, EA16- MP6, and EA5- MP7. From the matrices of correlation, the highest significant of relationship of MP with EA occurs with EA5 (taking environmental criteria into consideration) and MP 2 (through-put time reduction) at correlation value of 0.533. This results is similar with the study by [25] that indicates that sustainability has expanded the fundamentals of project development in the built environment. As for CA, a total of 91 relationships of matrices produced between MP and CA. From this matrices, a total of 14 (15.4%) produces a moderate relationship; and the remaining had produced a low level of relationship. From the matrices, the highest matrices of relationship occurs between CR11 (employee training/employee involvement) with MP2 (through-put time reduction) at positive correlation value of 0.592. As suggested by [26], the training programmed is important in setting a new set of Knowledge, Skills and Abilities (KSAs), behavior, or attitudes. These indicating that the participants of employees are important in increasing the level of MP.

## 4. Conclusion

In conclusion, the implementation of GSCM by Malaysian manufacturing firms is focusing on the activities that related in reducing the uses of natural sources. From the results, the level of MP is influenced by the level of sustainability in manufacturing operations. Two variables, namely EA and CA had contributes in improving the MP in establishing the GSCM. These findings are useful in establishing the strategy and setting the actions required in achieving high level of green practices in manufacturing firms.

**Table 1**  
Correlation between MP with EA and CR

Item	ENVIRONMENTAL ACTION		CUSTOMER ACTIVITIES	
	Moderate (0.400-0.599)	Low (<0.390)	Moderate (0.400-0.599)	Low (<0.390)
MP 1	ea1,ea 5, ea 11, ea 21	ea2,ea3,ea4,ea6,ea8,ea9,ea10,ea12,ea13,ea14,ea15,ea16,ea18,ea19,ea20	cr 11,cr 12	cr1,cr2,cr3,cr4,cr5,cr6,cr7,cr8,cr9,cr10,cr13
MP 2	ea 2, ea 5,ea 7	ea1,ea3,ea4,ea6,ea8,ea9,ea10,ea11,ea12,ea13,ea14,ea15,ea16,ea17,ea18,ea19,ea20,ea21	cr5,cr 8, cr 9,cr 11,cr 12	cr1,cr2,cr3,cr4,cr6,cr7,cr10,cr13
MP 3	ea 6	ea1,ea2,ea3,ea4,ea5,ea7,ea8,ea9,ea10,ea11,ea12,ea13,ea14,ea15,ea16,ea17,ea18,ea19,ea20,ea21	cr 11,cr 12	cr1,cr2,cr3,cr4,cr5,cr6,cr7,cr8,cr9,cr10,cr13
MP 4	ea 2,ea 5,ea 12	ea1,ea3,ea4,ea6,ea7,ea8,ea9,ea10,ea11,ea13,ea14,ea15,ea16,ea17,ea18,ea19,ea20,ea21	cr 8	cr1,cr2,cr3,cr4,cr5,cr6,cr7,cr9,cr10,cr11,cr12,cr13
MP 5	-	ea1,ea2,ea3,ea4,ea5,ea6,ea7,ea8,ea9,ea10,ea11,ea12,ea13,ea14,ea15,ea16,ea17,ea18,ea19,ea20,ea21	cr 9, cr 12	cr1,cr2,cr3,cr4,cr5,cr6,cr7,cr8,cr10,cr11,cr13
MP 6	-	ea1,ea2,ea3,ea4,ea5,ea6,ea7,ea8,ea9,ea10,ea11,ea12,ea13,ea15,ea17,ea18,ea19,ea20,ea21	cr 5	cr1,cr2,cr3,cr4,cr6,cr7,cr8,cr9,cr10,cr11,cr12,cr13
MP 7	-	ea1,ea2,ea3,ea4,ea5,ea7,ea8,ea9,ea10,ea11,ea12,ea13,ea14,ea15,ea16,ea17,ea18,ea19,ea20,ea21	cr 2	cr1,cr3,cr4,cr5,cr6,cr7,cr8,cr9,cr10,cr11,cr12,cr13

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## APPENDIX

1. How would you consider the performance of the manufacturing system, with respect to the following?

<i>no</i>	<i>Items</i>
MP 1	Lead time reduction
MP 2	Through-put time reduction
MP 3	Work-in-progress reduction
MP 4	Manufacturing cost reduction
MP 5	Product quality improvement
MP 6	Machine utilization improvement
MP 7	Flexibility improvement



2. In the last two years, company has taken in the following Customer Related Activities.

<i>no</i>	<i>Items</i>
CR 1	Identification of customer needs/customer focus
CR 2	(Re) Defining production / operations procedures to ensure greater efficiency
CR 3	Ensuring that staff are issued correct versions of documentation needed to perform task
CR 4	Ensure identity of preferred suppliers and a system for advising them of what is expected to be supplied
CR 5	Ensure training needs are identified and records of who has been trained in which topics
CR 6	Ensure customer complaints are properly addressed
CR 7	Ensure minimization and commitment to remove non-conformities
CR 8	Use of statistical process control (SPC)
CR 9	Identification of courses for non-conformity
CR 10	Ensure workers commitment
CR 11	Employee training / employee involvement
CR 12	Benchmarking
CR 13	Top management commitment

3. In the last two years, the company has taken environmental actions in the following areas.

<i>no</i>	<i>Items</i>
EA 1	Environment-friendly raw materials
EA 2	Substitution of environmental questionable materials
EA 3	Choice of suppliers by environmental criteria
EA 4	Urging/pressuring supplier(s) to take environmental actions
EA 5	Taking environmental criteria into consideration
EA 6	Design considerations
EA 7	Optimization of processes to reduce solid wastes
EA 8	Optimization of processes to reduce water use
EA 9	Optimization of processes to reduce air emissions
EA 10	Optimization of processes to reduce noise
EA 11	Use of cleaner technology processes to make savings (energy, water, wastes)
EA 12	Recycling of materials internal to the company
EA 13	Use of waste of other companies
EA 14	Use of alternative sources of energy
EA 15	Helping suppliers to establish their own EMS
EA 16	Recovery of the company's end-of-life products
EA 17	Eco-labeling
EA 18	Environmental improvement of packaging
EA 19	Taking back packaging
EA 20	Providing consumers with information on environmental friendly products and/or production methods
EA 21	Change for more environmental-friendly transportation