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Original Article

Green Supply Chain Model for Japanese Automotive Industry in Malaysia Using Level 2 SCOR

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Abstract: Environmental issues have become a significant concern for both the Malaysian government and the public. Environmental impacts arise at all stages of a product's supply chain life cycle. This study aims to identify the relationship between the Green SCOR Model at Level 2 and operational performance. Specifically, it investigates whether the process categories within the Green SCOR Model affect operational performance. Twenty-six hypotheses were tested, focusing on the core processes of the Green SCOR Model: plan, source, make, deliver, and return. The study was conducted at Mitsubishi Motors Sdn Bhd, located in Shah Alam, Selangor. Probability sampling was employed, with simple random sampling used to select participants. Data were collected via a survey questionnaire administered at Mitsubishi Motors Sdn Bhd. The findings reveal that six processes within the Green SCOR Model have a significant relationship with operational performance: source make-to-order, enable source, make-to-stock, make-to-order, deliver stocked product, and deliver return MRO product. This study provides an overview of the current state of Mitsubishi Motors' supply chain and offers managers a clear understanding of supply chain management in the Japanese automotive industry, enabling them to enhance both supply chain and operational performance.

Keywords: Green SCOR Model; Supply Chain Management; Operational Performance; Japanese Automotive Industry.

1. Introduction

In this rapid change of the global manufacturing scenario, environmental issues such as air pollution, climate change, global warming, ozone layer depletion, and solid waste are becoming more important in managing any business. The Malaysian government and public are focusing on the environmental issues in Malaysia (Eltayeb et al., 2011). Regulators at different levels enacted strict regulations due to the increasing environmental issues and resource depletion problem (Zhu et al., 2010). These stricter regulations have pushed manufacturers to adopt different environmental management practices in their industry (Zhu et al., 2013). These serious environmental problems are caused by waste and emissions of the supply chain (Kumar & Chandrakar, 2012). One of the main contributors to the economic growth in Malaysia is the manufacturing industry (Rozar et al., 2015). Unfortunately, it has caused trouble for the environment (DOE, 2010). Automotive industry is one of the manufacturing industries and it also caused the environmental problems to become worse. For the automotive industry, the main environmental impact from car production is solid waste generation, high energy and water consumption. Green supply chain management has been implemented by many manufacturing industries in Malaysia. Green supply chain management is an important approach to minimize the negative influence on the environment through the activities within supply chain and organization (Rozar et al., 2015). Currently, one of the models is adopting by manufacturing industry is Green SCOR model. The Green SCOR model combine green manufacture thought into traditional SCOR model (Qianhan et al., 2010). It helps the organization to take appropriate steps to mitigate those environmental impacts that often hidden in the supply chain processes. Hence, it will help to enhance the operation performance of an automotive industry by reducing the negative influence on environment.

1.1. An Overview

Mitsubishi Motors Malaysia Sdn Bhd is the exclusive distributor of Mitsubishi Motors vehicles in Malaysia. The company was established on 29 January 2005. Mitsubishi Motors Corporation is guided by core principles that emphasize corporate responsibility to society, integrity, fairness towards consumers, and the promotion of international understanding through trade. The company leverages its innovative capabilities to contribute to the improvement of society, the environment, and the global community, fulfilling its corporate social responsibility. Mitsubishi Motors Malaysia aims to achieve a harmonious balance between people and the planet by integrating driving performance with environmental consciousness. Its mission is encapsulated in the motto: “Driving pleasure and assured security.” Additionally, the company is committed to reducing its environmental footprint by minimizing gas emissions and solid waste generation. The manufacturing and assembly processes for Mitsubishi vehicles are conducted in Thailand.

In Malaysia, the company handles only accessory installation, which includes the installation of reverse sensors, front sensors, audio systems, reverse cameras, and other related components. Subsequent steps include fitting leather seat covers and applying tinted film after completing the manual accessory installation. If any malfunctions are detected in the installed accessories, the installation process is repeated. After quality checks are completed, the vehicles are transferred to the storage area to await distribution to customers. Despite these measures, the supply chain processes still contribute to environmental impacts, including the emission of gas pollutants and the generation of solid waste. This study will emphasize the application of the Green SCOR (Supply Chain Operations Reference) model and its relationship with the operational performance of the automotive industry. The Green SCOR model enables companies to analyze and enhance their supply chain processes, allowing managers to better understand and improve environmental performance across the supply chain.

Due to increase the demand of environmental friendly about the manufacturing processes, products and services from customers and governmental entities, managers are realized that it is important for their supply chain (Green et al., 2012). Therefore, environment impact are considering seriously by firm when doing their business due to these challenges and pressures (Khidir ElTayeb et al., 2010) According to world statistics, the automotive industry is world’s largest single manufacturing sector (Lettice et al., 2010). Automotive industry is a prospering business which not only brings many benefits but cause troubles to the environment (Yongan & Menghan, 2011). Environmental impact occurs at all stages of the supply chain life cycle of a product or service from extraction of raw materials, distribution, operation and disposal (Kumar & Chandrakar, 2012). For example, some waste will be generated from automotive industry if an automotive industry does not fully utilize their resources. These waste products may bring negative impact to our environment. It also will cause a high operation cost and poor operation performance of an industry. Therefore, Green SCOR model infiltrates the thought of environmental protection into supply chain analysis tool (Yongan & Menghan, 2011). This model will help an organization to reduce the waste through implementation of material recycle and waste disposal for products (Qianhan et al., 2010).

Some waste was generated from the Mitsubishi Motor’s supply chain. Seat cover of the car is one of the examples of solid waste in this company. The original seat cover of the car will take off and replaced with leather seat cover. So that, the original seat cover of the car will become a solid waste in this company. Thus, this study seeks to identify the relationship between green supply chain model (Green SCOR Model in Level 2) and operations performance.

2. Literature Review

2.1. Green Supply Chain Management

Green supply chain management (GSCM) has focused on the supply chain of different links of environmental problem and emphasized on environmental protection (Yan & Xia, 2011). GSCM integrates the environmental criteria or concern into traditional supply chain. According to Amemba et al., (2013), GSCM also defined as summing up of green procurement, green manufacturing, green distribution/marketing and reverse logistic. The idea of GSCM is to reduce or minimize waste in the form of energy, emission, hazardous, chemical and solid waste (Olugu et al., 2010). Greening the supply chain has a lot of benefits to an organization which include cost reduction, more organic and better cooperation with the suppliers. Manufacture has better cooperation with supplier to produce more environmentally friendly products. Nowadays, consumers are becoming more awarded to and involved in the growing green interests (Meera & Chitramani, 2014). According to Bhateja et al. (2011), consumers will prefer to buy more and pay more for the environmentally friendly products and services.

2.2. Environmental Management System (EMS)

An environmental management system is a management tool that enables an organization to establish environmental objectives, policies, and responsibilities (Hajikhani et al., 2012). It also helps an organization to reduce its potential environmental impacts, protect the environment and manage their daily activities in an environmentally friendly way. It contains a set of processes and practices that are used to minimize the environmental impacts and improve operation efficiency of an organization. ISO 14001 is the international standard for EMS and widely used in the world. Issues like establishment, implementation, maintenance and improvement of an EMS will be covered in this standard. The ISO 14001 will give detailed instructions on how to establish, implement evaluate and improve an EMS at every stages. The green practices in many manufacturing companies will be enhanced by environmental laws and ISO 14001 certifications (Meera & Chitramani, 2014).

2.3. Automotive industry

The growth in the world's population has increased the demand for the vehicles (Olugu et al., 2010). The increasing trend of demand leads to an increase the production of vehicles in the automotive industry. The main global environmental impacts from automotive industry are vehicle use, car production and final disposal of cars (Nunes & Bennett, 2010). According to Nunes & Bennett, (2010), the major environmental influence from the production process of car is the generation of solid waste, emission of voltaic organic compounds (VOCs), high energy and water consumption. In this research, Mitsubishi Motors have the problem of solid waste generation as stated in the problem statement.

2.4. Overview of Green SCOR Model

The Green SCOR model integrates environmental protection considerations into the traditional SCOR framework. It is structured into three process levels. The first level defines the scope of the supply chain and is used to assess the competitive performance of the entire supply chain. The second level, known as the configuration level, categorizes the supply chain into three primary types: make-to-stock, make-to-order, and engineer-to-order. The third level, referred to as the decomposition level, provides detailed descriptions of each process element defined at the second level (Supply Chain Council, Inc., 2010). The processes in the Green SCOR model aim to enhance supply chain efficiency by promoting optimal resource utilization while minimizing environmental impact (Yongan & Menghan, 2011). According to the Supply Chain Council's Green SCOR Model Version 10.0, the model consists of 26 Level 2 processes. Each of these Level 2 processes is further classified by type, which includes planning, execution, and enablement.

2.4.1. Plan

Plan processes involved the activities of stabilize resources with requirement and build a plans for the whole supply chain in an organization. Plan Supply Chain (sP1) process is to plan all the activities of supply chain in an organization. Plan source (sP2) is a process that related with the activities of building the course of action over specified time periods that appropriate with material resources. Plan make (sP3) process is to plan and build all the activities that related with make process. It plan the activities that related with make process based on the production requirements and resources. Plan deliver (sP4) process is to build and develop the activities that related with distribution process. Plan return (sP5) process is a strategic process to adjust the activities or tasks based on return requirements and resources. Enable plan (sEP) is a process that maintains and manages the information or relationships on plan process. It collected the processes related with managing and observing data, performance and relationships of the plan process (Supply Chain Council, Inc., 2010).

2.4.2. Source

The source processes related with purchasing, delivery, receipt and transfer of raw material items, subassemblies, product and/or services. Source stocked product (sS1) is the process of purchasing, receiving and transferring raw material and products or services based on aggregated demand requirements. Source make-to-order product (sS2) is the process of ordering and receiving material that is purchased only when received a specific customer order. Source engineer-to-order product (sS3) is the process of selecting sources of supply, ordering and receiving the material that are designed ordered or build based on the requirements of a specific customer order. Enable source (sES) is a process that manages and maintains the information on source process. It gathered all of the process related with administrating and supervising data, performance and relationships of the source process (Supply Chain Council, Inc., 2010).

2.4.3. Make

Make process refer to the flow of raw materials into finished goods. The make-to-stock (sM1) is the process of manufacturing in a make-to-stock environment. Make-to-stock products are produced according to planned schedule with a sales forecasting. Make-to-order (sM2) is the process of manufacturing for specific parts or products in specific quantities and planned availability of required sourced products. The make-to-order products are built and completed after receiving a customer order reference. Engineer-to-order (sM3) is a process of manufacturing a product based on the requirements of a specific customer. The work instructions and material routing instruction may need to be defined or modified in the engineer-to-order process. Enable make (sEM) is a process that manages the information that are related to make process. It collected the processes that related with the make data, relationships and performance (Supply Chain Council, Inc., 2010).

2.4.4. Deliver

The deliver processes involve the activities of fulfillment of customer orders. It includes storing, packaging, transporting and delivering finished products to the customer. Deliver stocked product (sD1) is the process of delivering product that is produced based on demand or projected orders and inventory level. Deliver make-to-order product (sD2) is the process of delivering product that is manufactured from a specific firm customer order. Deliver engineer-to-order product (sD3) is the process of delivering a product that is manufacture based on the requirements of specific customers. Deliver retail product (sD4) is the processes used to receive, store and sell finished goods at a retail store. A retail store sells the product directly to the customer. Merchandising at a store level is to push the sales in a retail store Enable Deliver (sED) is a process that manages and supervises the deliver information. It gathered all of processes related with deliver process data, performance and relationships (Supply Chain Council, Inc., 2010).

2.4.5. Return

The return processes related with the flow of materials from a customer back. This process also involved the activities of receiving the defective products, inspection, and delivery back the products to customer. Source return defective product (sSR1) is the process of returning and disposing of defective products to supplier. It also can execute metrics to detect defective products (Hofmann et al., 2013). Deliver return defective product (sDR1) is the process that addresses the receipt of returned the defective products from customers. It makes the return process become more standard such as set up electronic or pre-authorized returns (Hofmann et al, 2013). Source return MRO product (sSR2) is the process of returning of maintenance, repair and overhaul (MRO) products to supplier for repairing or upgrading it. Deliver return MRO product (sDR2) is the process that handles the receipt of returned MRO products from customers. Source return excess product (sSR3) is the process of returning the excess or out of date products to supplier. Deliver return excess product (sDR3) is a process that handles the receipt of return excess or obsolete products from customers. Enable return (sER) is a process that handles and control the information related to return process. It collected all of processes that correspond with return process data, performance and relationships (Supply Chain Council, Inc., 2010).

2.5. Advantages of Green SCOR Model

Supply chain management of an organization is full of challenges that can influence in higher costs and waste materials. An organization should take more attention in supply chain management. Some of the techniques such as analysis and restructuring that are the basic requirements to provide an effective supply chain of an organization. SCOR model is an effective and useful tool to help and solve the top five supply chain challenges which are superior customer services, cost control, planning and risk management, supplier relationship management and talent. (Supply Chain Council, Inc., 2010). Green SCOR model allows an organization to understand the operation mechanism. This will helps the supply chain managers to get a better view of supply chain operations performance (Yongan & Menghan, 2011). Green SCOR model involved various parties in supply chain which including suppliers, customers and shareholders. This leads an organization to gain an effective commutation with its suppliers and customers. This will result cost reduction and improvement of operation performance.

2.6. Operation Performance

Operations management is the major part that has direct impact on environment. This is because the product or services we make and the way we make them influence our environment (Weybrecht, 2014). Two evolving trends lead an organization more focused and emphasized the sustainability of operation management which include the stricter regulation and demand of environmental accountability (Hasan, 2013). Green SCOR model can helps an organization to eliminate the waste and high utilization of resources. It makes the manager managed their supply chain and environmental impact more easily and it results in more efficient operation and lower cost. A company can reduce its operation cost by using fewer and environment friendly raw materials, less energy, sustainable transportation, and water resources. These make their supply chain processes more efficient and less harmful to our environment (Weybrecht, 2014). Table 1 indicated that the items of measuring operation performance.

Table 1. The measurement of items in operation performance

No.	Measurement Items	Sources
1.	Cost savings	Adapted from Hasan (2013); (Hasrulnizzam et al. (2011).
2.	Sales	Adapted from Hasan (2013).
3.	Goods delivery on time	Adapted from Zhu et al. (2010).
4.	Product Quality	Adapted from Hasan (2013); Hasrulnizzam et al. (2011); Zhu et al. (2010).
5.	Lead time	Adapted from Hasrulnizzam et al. (2011).
6.	Work-in-progress	Adapted from Hasrulnizzam et al. (2011).

2.7. Waste Management

Nowadays, many pressures are combined to lead waste management becomes a focus point for sustainability. Some of the activities that add significant cost to a business are transportation, production processes, and disposal of waste particularly when the waste is hazardous (Weybrecht, 2014). A company that used raw materials ineffectively, inefficiently and incompletely in production process will contribute pollution and waste to our environment (Weybrecht, 2014). Effective waste management can be achieved from preventing waste at the gathering raw materials and manufacturing processes rather than removed it after it has been created. According to Amemba et al., (2013), an organization can manage and control waste through efficient usage of materials instead of having to wait until the waste has accumulated.

2.8. Conceptual Framework and Hypotheses

Based on the literature review discussed in previous section, a conceptual framework in figure 2 and several hypotheses have been developed as shown below.

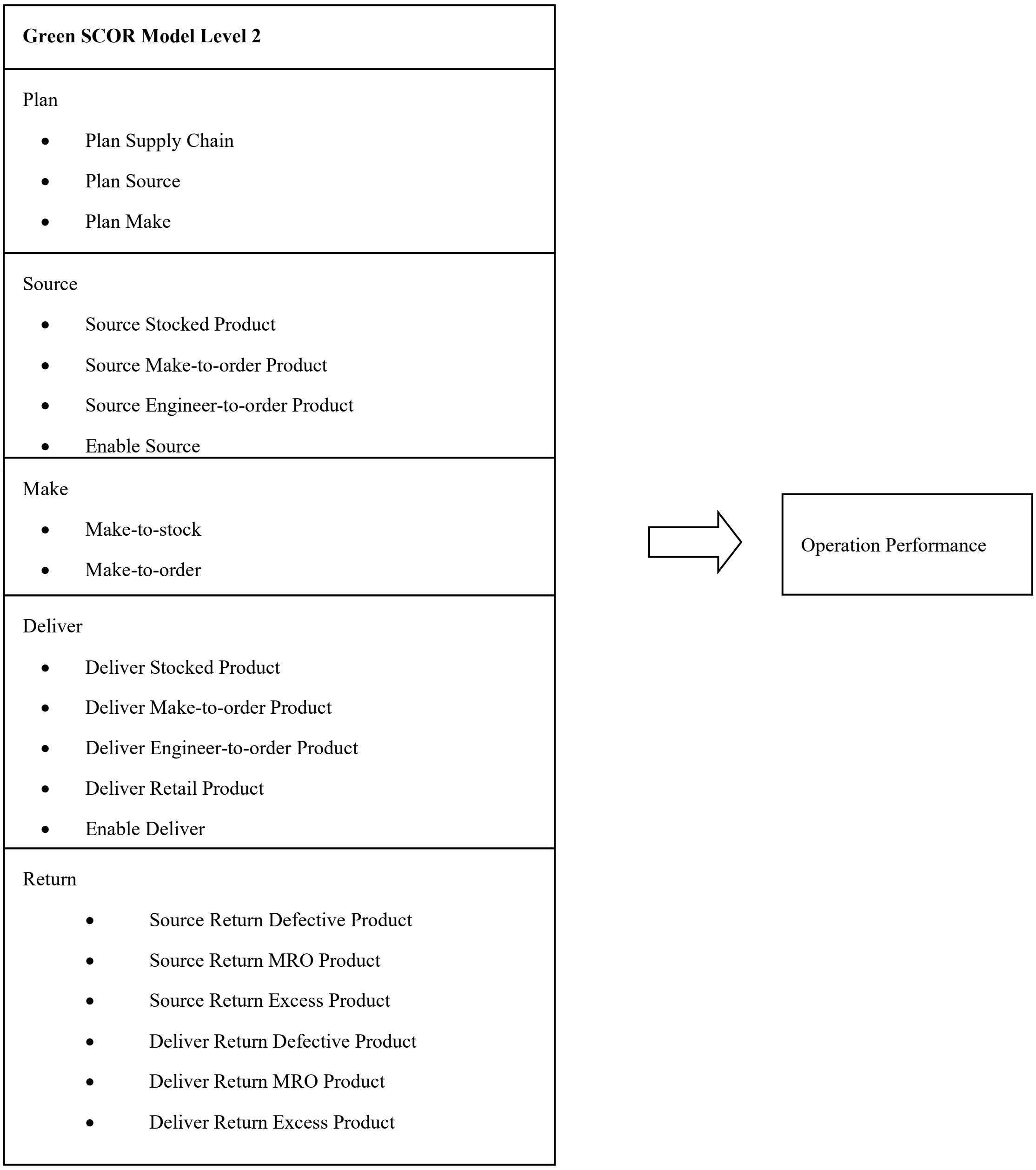

Figure 1. Conceptual Framework

H1: Planning Processes and Operational Performance

H1a: There is a significant relationship between supply chain planning and operational performance.
H1b: There is a significant relationship between source planning and operational performance.
H1c: There is a significant relationship between make planning and operational performance.
H1d: There is a significant relationship between delivery planning and operational performance.
H1e: There is a significant relationship between return planning and operational performance.
H1f: There is a significant relationship between enabling planning processes and operational performance.

H2: Sourcing Processes and Operational Performance

H2a: There is a significant relationship between sourcing stocked products and operational performance.
H2b: There is a significant relationship between sourcing make-to-order products and operational performance.

H2c: There is a significant relationship between sourcing engineer-to-order products and operational performance.
H2d: There is a significant relationship between enabling sourcing processes and operational performance.

H3: Making Processes and Operational Performance
H3a: There is a significant relationship between make-to-stock processes and operational performance.
H3b: There is a significant relationship between make-to-order processes and operational performance.
H3c: There is a significant relationship between engineer-to-order processes and operational performance.
H3d: There is a significant relationship between enabling make processes and operational performance.
H4: Delivery Processes and Operational Performance
H4a: There is a significant relationship between delivering stocked products and operational performance.
H4b: There is a significant relationship between delivering make-to-order products and operational performance.
H4c: There is a significant relationship between delivering engineer-to-order products and operational performance.
H4d: There is a significant relationship between delivering retail products and operational performance.
H4e: There is a significant relationship between enabling delivery processes and operational performance.

H5: Return Processes and Operational Performance
H5a: There is a significant relationship between returning defective products (source) and operational performance.
H5b: There is a significant relationship between returning maintenance, repair, and operations (MRO) products (source) and operational performance.
H5c: There is a significant relationship between returning excess products (source) and operational performance.
H5d: There is a significant relationship between returning defective products (deliver) and operational performance.
H5e: There is a significant relationship between returning MRO products (deliver) and operational performance.
H5f: There is a significant relationship between returning excess products (deliver) and operational performance.
H5g: There is a significant relationship between enabling return processes and operational performance.

3. Materials and Methods

3.1. Research Design

Quantitative research approach was conducted in this study. Quantitative research can collect much data that can be easily arranged and manipulated into reports for analysis. This research was conducted through an experimental way to gain numerical data for analysis by using a statistical test. This research is a descriptive and correlation study.

3.2. Research Process

A flow diagram was established to ensure this research can be carried out smoothly. There are several stages found in the flow diagram. First, the research problem is identified. Secondly, literature is reviewed for providing an important perspective for the researcher. Then, the conceptual framework and several hypotheses were developed. After that, the questionnaire of this research was designed and undergoes the stage of pilot test for further refinement. SPSS version 22.0 was used to analyses the data collected from respondents (Yan & Xia, 2011). The following figure 2 shows the steps flow from the beginning until the end of research process.

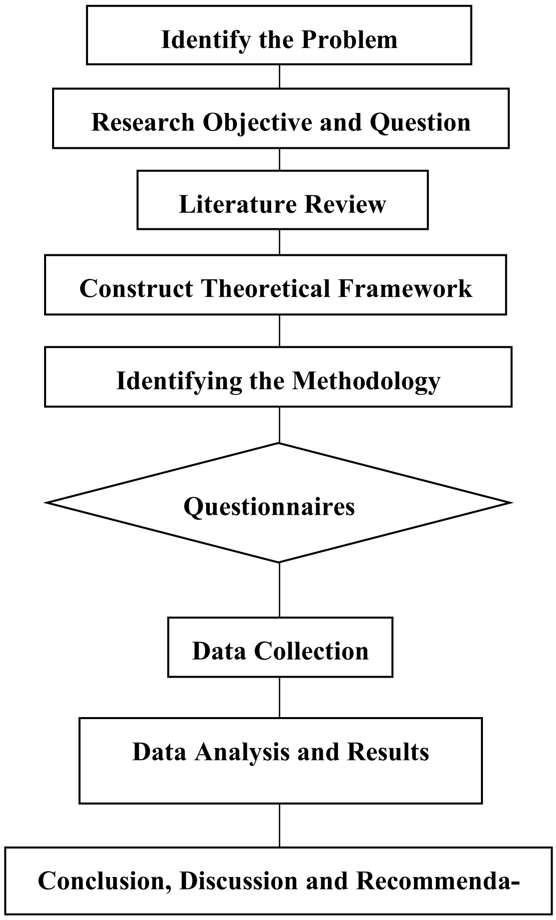

Figure 2. Research flow chart

3.3. Sampling Design

Sampling is involved with the selection of participants from the population. The selection of sample is very important in the research. Probability sampling was selected, and simple random sampling was chosen in this study. Simple random sampling is everyone was selected randomly such as everyone has same chance and possibility of being chosen from a particular population.

3.4. Population and Sample

The target population of this study is the employees of Mitsubishi Motors Sdn Bhd who are related with supply chain. The sample of this study is the managers in different departments of supply chain and employees that involved in the supply chain at Mitsubishi Motors Sdn Bhd.

3.5. Data Collection

This study was carried out by using survey method and a questionnaire was used to collect data. This questionnaire contains three sections. Section A is demographic information of the respondents. Section B is the process categories of Green SCOR Model Level 2. Section C contains questions relating to the relationship between Green SCOR Model and operation performance. The measurement of these items is using a five-point Likert Scales (Zhu et al., 2013). The rating scales from 1=strongly disagree until 5=strongly agree.

3.6. Pilot Study

A pilot test was conducted before the distribution of the questionnaire to real respondents. Pilot test was used in this research to investigate and examine whether the respondent can understand the questions from survey questionnaires or not. It also can help enhance the quality of the questionnaire. Misunderstanding and confusion problems about the questions were reduced. Pilot test was used to evaluate and assess the appropriateness of question design to make sure the questionnaire related and suitable to this study.

4. Results

4.1. Response Rate

A total of 50 sets of questionnaires have been distributed to the company through email and face-to-face distributed the questionnaires. There are only 30 sets of questionnaires were received back excluding 7 sets of questionnaires for pilot test. The respond rate for this study is 60 percent.

4.2. Reliability Analysis

The reliability test for Green SCOR Model Level 2 in pilot test showed that the value of Cornbrash's alpha for Green SCOR Model Level 2 is 0.911 while the operation performance is 0.703. The results of pilot test indicated that the values of both variables are above 0.7 which are the variables established an acceptable level and it can be used for the real study (Khidir ElTayeb et al., 2010). After the real survey has been conducted, the value of Cornbrash's alpha for Green SCOR Model Level 2 is 0.933 while operation performance is 0.848. It can be considered as acceptable.

4.3. Demographic Analysis

The total number of respondents that are involved in this study is 30 respondents. There were 12 female respondents (40%) and 18 male respondents (60%) in this research. Out of 30 respondents, there were almost half the respondents are within the age 31 to 40 which have 18 respondents (60%). The rest of the respondents are within the age 21 to 30 which have 12 respondents (40%). The highest numbers of respondents were from manager position (9 respondents/30%). This was followed by officer and employee (8 respondents/26.7%), and assistant manager (5 respondents/16.7%). Most of the respondents have been working with this company less than 5 years which has 25 respondents or 83.3%. The rest of the respondents have been working within the 6 years until 10 years which have 5 respondents or 16.7%. Out of 30 respondents, there were 22 respondents (73.3%) are bachelor's degree holder. There are 4 respondents (13.3%) are diploma holder and holding another certificate.

4.4. Descriptive Analysis

Mean and standard deviation were selected to analyze the collected data in this study. Majority of the variables show moderate mean score. Most of the green practices were used moderately in the automotive industry. The detail result was shown in Figure 3.

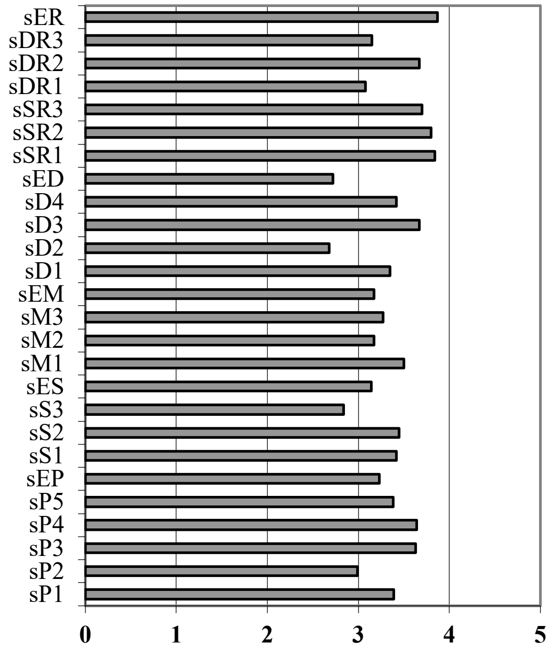

Figure 3. Mean score of the practices in Green SCOR Model Level 2 implemented in the organization

4.5. Normality test

Shapiro-Wilk test was selected due to the 30 sets of questionnaires was collected from this research ($n<50$) (Ho, 2014). In this study, most of the compute variables show that the data are not normal. Only four compute variables show that the data have come from normally distributed populations which are sP2, sS2, sED and operation performance. The Z-score of skewness and kurtosis for these four compute variables indicate that the values are in the span +1.96 to -1.96. The Shapiro-Wilk's p-value is greater than 0.05, it can be assumed that the null hypothesis of these compute variable cannot be rejected and the data are normal (Shapiro & Wilk, 1965). The rest of the compute variables indicate that the data have come from not normally distributed populations The Z-score of skewness and kurtosis for these compute variables are in the span +1.96 to -1.96 except for plan supply chain, plan return, engineer-to-order, enable make and deliver retail product. The p-value of Shapiro-Wilk of these compute variables are less than 0.05. These compute variables can be assumed that the data are not normal, and the null hypothesis can be rejected.

4.6. Correlation

According to the result, The process of source make-to-order product (sS2), enable source (sES), make-to-stock (sM1), make-to-order (sM2), deliver stocked product (sD1) and deliver return MRO product (sDR2) have smaller significant value compared to others variables which are less than 0.05 (Ho, 2014). Therefore, these compute variables show significant relationship with operation performance. The rest of compute variables' significant values are larger than 0.05 which means that these compute variables does not reflect significant relationship with operation performance. The correlation coefficient of sS2 is 0.456 and it shows the moderate positive relationship with operation performance. The correlation coefficient of sES is 0.416 and it can assume that moderate positive relationship between enable source and operation performance. The correlation coefficient of sM1 is 0.453 and it indicates moderate positive relationship with operation performance. The correlation coefficient of sM2 is 0.384 and there is weak positive relationship exists between make-to-order process and operation performance. The correlation coefficient of sD1 is 0.362 and it can assume that weak positive relationship between deliver stocked product and operation performance. The correlation coefficient of sDR2 is 0.384 and it can assume that weak positive relationship between deliver return MRO product and operation performance.

Table 2. The correlation results in Green SCOR Model and operation performance

Test Statistics			**Compute Operation**
Spearman's rho	Compute sP1	Correlation Coefficient	0.183
		Sig. (2-tailed)	0.332
Pearson	Compute sP2	Correlation Coefficient	0.295
		Sig. (2-tailed)	0.113
Spearman's rho	Compute sP3	Correlation Coefficient	0.106
		Sig. (2-tailed)	0.577
Spearman's rho	Compute sP4	Correlation Coefficient	0.140
		Sig. (2-tailed)	0.462
Spearman's rho	Compute sP5	Correlation Coefficient	-0.031
		Sig. (2-tailed)	0.870
Spearman's rho	Compute sEP	Correlation Coefficient	0.326
		Sig. (2-tailed)	0.079
Spearman's rho	Compute sS1	Correlation Coefficient	0.249
		Sig. (2-tailed)	0.185
Pearson	Compute sS2	Correlation Coefficient	0.456*
		Sig. (2-tailed)	0.011
Spearman's rho	Compute sS3	Correlation Coefficient	0.323
		Sig. (2-tailed)	0.082
Spearman's rho	Compute sES	Correlation Coefficient	0.416*
		Sig. (2-tailed)	0.022
Spearman's rho	Compute sM1	Correlation Coefficient	0.453*
		Sig. (2-tailed)	0.012
Spearman's rho	Compute sM2	Correlation Coefficient	0.384*
		Sig. (2-tailed)	0.036
Spearman's rho	Compute sM3	Correlation Coefficient	0.261
		Sig. (2-tailed)	0.164
Spearman's rho	Compute sEM	Correlation Coefficient	0.178
		Sig. (2-tailed)	0.347
Spearman's rho	Compute sD1	Correlation Coefficient	0.362*
		Sig. (2-tailed)	0.049
Spearman's rho	Compute sD2	Correlation Coefficient	0.293
		Sig. (2-tailed)	0.117
Spearman's rho	Compute sD3	Correlation Coefficient	0.281
		Sig. (2-tailed)	0.132
Spearman's rho	Compute sD4	Correlation Coefficient	0.024
		Sig. (2-tailed)	0.900
Pearson	Compute sED	Correlation Coefficient	-0.020
		Sig. (2-tailed)	0.916
Spearman's rho	Compute sSR1	Correlation Coefficient	-0.164
		Sig. (2-tailed)	0.386
Spearman's rho	Compute sSR2	Correlation Coefficient	0.235
		Sig. (2-tailed)	0.211
Spearman's rho	Compute sSR3	Correlation Coefficient	0.155
		Sig. (2-tailed)	0.415
Spearman's rho	Compute sDR1	Correlation Coefficient	0.009
		Sig. (2-tailed)	0.961
Spearman's rho	Compute sDR2	Correlation Coefficient	0.384*
		Sig. (2-tailed)	0.036
Spearman's rho	Compute sDR3	Correlation Coefficient	0.064

		Sig. (2-tailed)	0.737
Spearman's rho	Compute sER	Correlation Coefficient	0.263
		Sig. (2-tailed)	0.161

5. Discussion

There is no significant relationship between the Green SCOR Model at Level 2 and operational performance. Specifically, the hypotheses 1a, 1b, 1c, 1d, 1e, and 1f related to the planning processes were not supported. Previous studies have highlighted that the planning supply chain process requires balancing resources based on demand, enabling the execution of a series of action programs to provide better supply chain service (Yongan & Menghan, 2011). An organization's supply chain must integrate green purchasing, green manufacturing, green distribution, and green reverse logistics. Green procurement can be achieved by greening the company's resources (Choong et al., 2015). Automotive manufacturing should follow environmentally friendly principles (Yongan & Menghan, 2011). The distribution process should incorporate environmental technologies to optimize resource utilization and reduce the environmental impact of logistics activities (Qianhan et al., 2010). Products that are recyclable and reusable are returned to manufacturers (Yongan & Menghan, 2011). These activities occur in reverse logistics, which involves retrieving products from customers, including returns of defective or excess products to suppliers. Information related to the planning processes plays a key role in green planning within an organization. A higher capability of the organization's information systems to gather data concerning environmental sustainability efforts and the outcomes of procurement, manufacturing, sales, and logistics processes will contribute to successful implementation of green supply chain practices (Preuss, 2002).

A green information system provides the necessary data to support decision-making that enhances environmental sustainability throughout the entire supply chain (Green et al., 2012). In the sourcing process, hypothesis 2a was not supported. The primary function of the sourcing of stocked products is to maintain a predetermined inventory level of raw materials. Purchasing raw materials based on storage capacity helps reduce inefficient "convenience purchasing" cycles. Reducing the frequency of purchases lowers overall costs and decreases greenhouse gas emissions from transportation (NASPO Green Purchasing Guide). Hypothesis 2b was supported in this study. Previous research indicates that auto manufacturers purchase raw materials, parts, and modules that meet their specifications as part of the source make-to-order product process (Yongan & Menghan, 2011). This process helps organizations reduce excess raw materials and limits their exposure to financial risk.

Hypothesis 2c was not supported. The source engineer-to-order product process involves procurement based on the specific requirements of a customer order (Hofmann et al., 2013). A major factor in green purchasing is providing design specifications to suppliers that include environmental requirements for purchased items (Zsidisin & Hendrick, 1998). Supplier involvement in design processes and technology development significantly influences overall supply chain performance (Sarkar & Mohapatra, 2006). Hypothesis 2d was supported. According to Green et al., (2012), green information systems have a direct and positive impact on green purchasing. Green purchasing, in turn, affects both economic and operational performance (Green et al., 2012). The procurement department must actively participate in all supply chain management activities, particularly in purchasing reused and recycled materials, to promote resource reuse and recycling (Carter & Carter, 1998).

In make type of process, it has four process categories which is make-to-stock, make-to-order, engineer-to-order and enable make. The hypothesis 3a was supported. From the previous study, the auto manufacturer produces its products by its six-month-volume forecast as Make-to-stock (Yongan & Menghan, 2011). According to Immawan et al., (2015), make-to-stock process has lower variety of customization and usually less expensive products. Make-to-stock process has high fill rate, planning for inventory, identifying lot sizes and forecasting of demand (Immawan et al., 2015). This process can avoid opportunity loss due to out of stock and reduce excess inventory if using accurate forecasts. The hypothesis 3b was supported. Make-to-order process is highly customized and usually expensive products. This process has short delivery lead time, capacity planning, order acceptance or rejection and high due-date adherence (Immawan et al., 2015). Make-to-order process can supply their customer with the exact product required, it will reduce sales discounts, inventory and stock obsolescence risk. The hypothesis 3c was not supported. Engineer-to-order mode is the less favorably on manufacturing functions when compared to the mode of make-to-stock and make-to-order (Rathmann, 2011). According to Hicks et al., (2000), it has three key phase that require coordination in engineer-to-order process which are tendering (sales/marketing), product development (engineering) and product realization (production). The hypothesis 3d was not supported.

Environmental protection concept are added into production process can lead to production efficiency gains and reduced environmental and occupational safety expenses and enhance corporate image (Amemba et al., 2013). Enable make process has ability to maintain the performance at an optimal level of production in the long-term by using the available resources effectively (Habidin et al., 2015). The majority of the practices in green manufacturing include the waste-directed approached in order to enhance the feasibility of product recovery feasibility and the values created by product recovery management (Bloemhof-Ruwaard et al., 1995).

In deliver type of process has five processes as mentioned in the literature review. Out of five processes, there is only one process that has a significant relationship with operation performance which is deliver stocked product. It can be assumed that deliver stocked product process is implemented in the automotive industry. The hypothesis 4a was supported. The green practices in deliver stocked product were moderate used in the automotive industry. From the previous study, green distribution practices have a significant relationship with firm performance (Jemutai, 2014) The most used green practices in green distribution are to promote the program of recycling and reuse among workers to standardize packaging of product (Jemutai, 2014). The hypothesis 4b was not supported. The automotive industry is unlikely to choose to deliver make-to-order product process as its green distribution process. Supplier deliver the products to the auto manufacturer as deliver make-to-order product whereas the recycle center deliver the recycled materials as receive supplier's purchasing order to auto manufacturer as deliver make-to-order product (Yongan & Menghan, 2011). The hypothesis 4c was not supported. Deliver engineers-to-order product process should take consideration on packaging characteristics such as size, shape, and materials (Amemba et al., 2013). Better packaging and rearranged loading patterns can minimizing the materials usage, increasing space utilization in the warehouse and reducing the amount of handling required (Amemba et al., 2013). The hypothesis 4d was not supported.

Green practices that are related with deliver retail product process is optimizing transportation of goods which includes enhancing routes and scheduling, modal shift, partnership and backhauling opportunities. The hypothesis 4e was not supported. This process has used different strategies to manage the logistics process's performance such as product packaging and alternative fuel vehicles to minimize the environmental and energy footprint of freight distribution (Rodrigue et al., 2008). The company can adopt a more environmentally friendly transportation approach (Rao & Holt, 2005) and utilize recyclable or reusable packaging (Shang et al., 2010) to reduce the burden of the products delivery. In return type process, it has seven processes but only one process has significant relationship with operation performance. These processes can refer to reverse logistics that involved returns management, product repair and refurbishment, recycling of goods and materials and proper disposal of materials from unwanted goods. The hypothesis 5a was not supported. The organization should understand the reasons of returning goods to supplier. Normally, the reasons of returning goods are non-conforming goods and damaged goods. According to (Hofmann et al., 2013), an organization will execute metrics to detect defective product and specify the return conditions with suppliers. Reverse logistics can help manufacturing to handle returns and defective or obsolete goods efficiently with an eye toward reducing costs (Partridge, 2010). The hypothesis 5b was not supported.

The products that have been undergone MRO process are expected to be a usable condition. The manufacturing reuses the MRO product instead of buying a new products or raw materials from their suppliers. The products such as recovering products and refurbishing goods can be reused or recycled are sustainable processes and it can bring a lot advantages to environment and company (Partridge, 2010). The hypothesis 5c was not supported. The sSR3 process is determined by the terms and condition of a supplier contract (Supply Chain Council, Inc., 2010). It may include logistics cost of organizing, shipping of products and forth (Chou, 2009). The excess product can be returned to suppliers and the suppliers can rearrange the products or goods to other customers. The hypothesis 5d was not supported. Normally, deliver return defective product process will be implemented by customers when the products have serious problems (Yongan & Menghan, 2011). The manufacturer can execute policies to recycle the defective product by separating damaged items and feeding components that pass testing back into assembly line (Mark Graf). The hypothesis 5e was supported. This process is reverse logistics by providing exchanges systems, in-warranty repair, out-of-warranty repair, maintenance, upgrade, remanufacturing, and end-of-life product recovery (Computer Sciences Corporation). Reverse logistics can enhance customer satisfaction, loyalty and product life cycle. It also can obtain feedback from customers to make improvements and to know the real reasons for product return.

The hypothesis 5f was not supported. This process may involve the manufacturer needing to redistribute usable returned goods between its retail customers (Harrison et al., 2004). Deliver return excess product process may produce many disruptions in inventory management (Harrison et al., 2004). Manufacturers should carefully measure these short-term disruptions with long-term benefits of a coordinated reverse logistics process. The hypothesis 5g was not supported in this research. Enable return process includes managing rules, performance, data collection, transportation and risk that are related with return process. Enable return process includes controlling the flow of goods, inventory and information to recapture value or proper disposal and meet customer requirements (Computer Sciences Corporation). Managing the information of reverse logistics is very important part in this process. According to Rogers & Tibben-Lembke, (1999), the manufacturer can understand the real reasons for returned product and make corrections on defect or quality issues by gaining reliable and accurate information.

6. Conclusion, Limitation and Recommendation for Future Research

6.1. Conclusion

In conclusion, this study has been successfully completed, with the research objectives clearly achieved. The findings indicate that several processes within the Green SCOR Model at Level 2 have a significant relationship with operational performance. These include source make-to-order product, enable source, make-to-stock, make-to-order, deliver stocked product, and deliver return MRO product. This study offers valuable insights for the Japanese automotive industry, particularly in understanding the current state of its supply chain. The Green SCOR Model serves as a practical framework that enables manufacturers to communicate effectively with partners, identify supply chain issues, and assess supply chain performance. As environmental concerns become increasingly critical across all industries, the automotive sector must adopt different strategies to address sustainability challenges. Developing effective strategies requires a deep understanding of supply chain activities, green practices, and the associated implementation challenges. Industries that have successfully implemented green initiatives have demonstrated improvements in supply chain efficiency, operational performance, cost reduction, and environmental impact mitigation. Specifically, this study provides a clear picture of Mitsubishi Motors' supply chain, highlighting that only six processes currently influence operational performance. This insight can guide Mitsubishi Motors in refining and enhancing its supply chain based on the Green SCOR Model. The company is encouraged to place greater emphasis on the remaining processes—such as sP1, sP2, sP3, sP4, sP5, sEP, sS1, sS3, sM3, sEM, sD2, sD3, sD4, sED, sSR1, sSR2, sSR3, sDR1, sDR3, and sER, in order to further reduce environmental impact and improve performance. In other words, the findings suggest that Mitsubishi Motors' current supply chain is not yet fully prepared to implement the Green SCOR Model comprehensively. Therefore, strategic improvements are necessary to transition towards a more sustainable and efficient supply chain.

6.1. Limitation

This study is subject to several limitations that should be acknowledged. A key limitation is the relatively small sample size, with data obtained from only 30 respondents at Mitsubishi Motors Sdn Bhd. Given the limited scope and focus on a single organization, the findings may not be generalizable to the broader Japanese automotive industry operating in Malaysia. Additionally, the study was constrained by time limitations, which affected the data collection process. Due to the restricted timeframe, data were collected solely through questionnaires, a method that typically requires extended periods for distribution and response. The limited duration allocated for the study may have impeded the opportunity to employ more comprehensive data collection techniques, such as interviews or longitudinal analysis, thereby restricting the depth and richness of the findings.

6.2. Recommendation for Future Research

Future research could expand its scope by examining other automotive companies that have actively implemented green practices within their supply chains, such as Honda. Including a wider range of companies would enhance the generalizability of the findings and provide more accurate and reliable insights into the effectiveness of the Green SCOR Model across the industry. Increasing the sample size is also recommended to strengthen the statistical validity of the results. A larger dataset would allow for more robust analysis and a better representation of industry-wide trends and practices. In addition, future studies are encouraged to adopt qualitative research methods to gain deeper insights into the implementation and perception of the Green SCOR Model. Qualitative approaches, such as interviews, offer the opportunity to explore participants' views in greater depth. This method allows respondents to share their perspectives and experiences more openly, thus enabling researchers to obtain richer, more nuanced information that may not be captured through quantitative surveys alone. By integrating both quantitative and qualitative methods, future research can develop a more comprehensive understanding of green supply chain practices within the automotive industry.

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