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The Level of Adoption of Green Supply Chain Management and Green Innovation in Malaysian Manufacturing Industries

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Abstract:
Recently, corporate environmental practice such as Green Supply Chain Management (GSCM) and green innovation appears as a novel organized environmental practice for manufacturing companies to handle the increasing environmental issues. The aim of this paper is to assess the level of adoption of GSCM and green innovation practices. A total of 123 responses from Malaysian manufacturing companies were collected from mail questionnaire. The results showed Malaysian manufacturing companies are in trial adoption stage for both GSCM practices and green innovation. Internal environmental management practice of GSCM practices are relatively high adopted in Malaysian manufacturing organisation. Meanwhile, most of all green innovation practices are heavily implemented in Malaysian manufacturing companies. This paper empirically attempts to provide understanding and new insights for sustainability management area where GSCM and green innovation practices are important to improve organisational environmental performance, which can directly offer great benefits for both researchers and practitioners.

Keywords—GSCM, green innovation, environmental issues, environmental, manufacturing industry

1.0 INTRODUCTION

Environmental issues has been a noteworthy worry for firms since the community increasingly gained awareness of the harm that produced from firms' unsustainable strategies (Pietro, 2012). Most environmental issues such as global warming, solid waste management, air pollution, forest management and ozone layer depletion originated from manufacturing firms which seeks for turnovers boosting (Kamaruddin *et al.*, 2013). The consciousness of the community not only transforms their daily life, but it also has gained a new culture to induce many of the products going green and reduce hazardous material resources (Choong *et al.*, 2015). The introduction of current environmental directives for example the Waste Electrical and Electronic Equipment (WEEE), Restriction of Hazardous Substances (RoHS), and Eco-design for Energy using Products (EuP), the European Union (EU) have forced organisations to extend their environmental practices to their suppliers and customers. The increasing of international environmental regulations and rising consumer distress on environmental protection have revealed the significance of environmental management in manufacturing activities (Dangelico & Pujari, 2010). With these increasing pressures, manufacturing firms are pushed to actively engage in environmental management in order to meet the requirement of sustainable development (Tseng *et al.*, 2013). There has been an exigency to incorporate

ecological activities, inside the organization, as well as over the whole supply chain keeping in mind the end goal to guarantee the firm' sustainability (Cote *et al.*, 2008).

In this manner, manufacturer need to perform quick to execute green into the production line to guarantee its product satisfy did not comprised over risky materials. Nowadays, environmental issue are turn out to be a crucial requirement as important to work associated to manufacturing (New *et al.*, 2002). Numerous companies began to implement some of corporate environmental management (Zhu *et al.*, 2008) specifically supposed to overwhelm those issues. As such, the best place to begin embracing green will be supply chain and green innovation. As indicated by Vachon and Klassen (2007), Vachon and Klassen (2006), and Vasileiou and Morris (2006), environmental sustainability is priority on a supply chain rather than an organizational goal. Green supply chain management (GSCM) is one of corporate ecological that had been perceived and employed by manufacturing firms (Chiou *et al.*, 2011). It attempts to diminish or limit negative environmental effect, for example, contamination, surplus of resources, and product dumping (Hervani *et al.*, 2005).

The adoption of GSCM within business operation is also anticipated to improve other business performance. In fact, GSCM play as an environmental sustainability effort will finally turn into increased market share and profitability. Besides, green innovation is other environmental management concept that is now promoted in order to reduce the issues of environmental pollution (Chen, 2008; Chen & Chang, 2011). It likewise can help to enhance the execution of GSCM in conforming to the current environmental directives (Chen *et al.*, 2006). Innovation that consented to environmental directives additionally can enhance product constancy and superiority, decrease product costs and enhance source efficiency (Chen *et al.*, 2006; Porter & Linde, 1995). To reach companies' growth in the future, green innovation is specifically desired in companies' activities to establish new markets as market forecast show that these fields will encounter above average growth in the next 10 years, which may offer several potential and opportunities (Walz & Eichhammer, 2012). Green innovation concept can promote the implementation of GSCM by offering new ideas and approaches to manufacturers. This is supported by Chen *et al.* (2006) who asserted that green innovation may encourage increment the execution of environmental management particularly GSCM, in satisfying the organization's environmental obligation.

Numerous studies discussed on the level of adoption of GSCM practices in both of developed and developing countries. But, still limited studies surveyed on the level of adoption of green innovation practices especially in Malaysia context (Seman *et al.*, 2012a). The level of adoption of GSCM and green innovation practices is significantly varied for each country depend on certain barriers that they confront in their respective country such as company size, mode of implementation (Rao, 2002), and different surrounding pressures include of internal and external pressures including the government environmental regulations, legislation, customers, suppliers, buyers, and communities (e.g. Branco & Rodrigues, 2007; Darnall *et al.*, 2010; Sarkis *et al.*, 2010; Frondel *et al.* 2008). Previous studies show that GSCM practices in developed nations, such as Japan, Germany and other

northern European countries are very advanced (Gutowski *et al.*, 2005). However, in developing countries like Malaysia, GSCM is a relatively new concept both in practice and in research (Rao, 2002).

Regarding the green innovation field, very few studies have been done on green innovation practices specifically in developing countries like Malaysia. Some previous studies in developed countries such as United States and Sweden (Carrion-Flores & Innes, 2010; Gluch *et al.*, 2009) and developing countries (Alhadid & Abu-Rumman, 2014; Lee *et al.*, 2014; Weng *et al.*, 2015; Chang, 2011; Kucukoglu & Pinar, 2015; Conding & Habidin, 2012; Abdullah *et al.*, 2015; Zailani *et al.*, 2011; Zailani *et al.*, 2015) have done significant research in green innovation.Thus, to the best of our knowledge, this study will focus on the level of GSCM and green innovation among manufacturing firms. Given this issue, there is a forthcoming need to investigate the current level of implementation of GSCM and green innovation practices among Malaysian manufacturers. This paper will attempt to examine the level of implementation of GSCM practices and green innovation by Malaysian manufacturers within their business operation. This study will then provide some review of GSCM practices and green innovation. At the end, this study will discuss the results and discussion, and finally provide a conclusion.

2.0 LITERATURE REVIEW

Nowadays, global environmental issues have received serious attention from multiple stakeholders such as governments, societies, customers, suppliers, buyers and business organisations (Ramli and Munisamy 2012; Rozar *et al.*, 2015). Several companies have given huge attention to this environmental issue by improving their practices in the supply chain (Rostamzadeh *et al.*, 2015). The environmental problems includes global warming, ozone depletion, solid waste and air pollution are expected to be contributed by manufacturing industry (Ho *et al.*, 2015; Hassan *et al.*, 2016). GSCM and green innovation issues have appeared as primary concerns for industry to respond to a growing number of environmental regulations (Lin, 2011). Thus, we believe by exploring the level of adoption of GSCM and green innovation, it will be valuable toward Malaysian manufacturing industries in order to improve their environmental performance.

2.1 Green Supply Chain Management (GSCM)

Since the past fifty years, the concept of supply chain have advanced from dyadic relationship between customer and supplier through data sharing to vital coordinated efforts among supply chain accomplices and, during the most recent decade, the emphasis is on the ecological issues for singular organizations as well as for the entire supply chains (Centobelli *et al.*, 2018). Green supply chain management (GSCM) is a developing domain driven by the essential for environmental awareness (Srivastava, 2007). In essence, Zhu and Sarkis (2004)

and Zhu *et al.* (2008abc) described GSCM as an environmental practice that has been extended from green purchasing to integrated supply chains which begins from suppliers, to manufacturer, to customer, and the term reverse logistics, which is referred as 'closing the loop". According to Mathivathanan *et al.* (2018), GSCM can also be referred as a set of practices that involves actions beginning from the conception creation and advancing through green product design, purchasing, logistics, manufacturing, and dealing with all types of wastes (Mathivathanan *et al.*,2018). There are several practices of GSCM that have been used widely by many researcher in this field. In this study, we only embraced the most regularly utilized and exceptionally referred to set of internal and external GSCM practices formulated by Zhu *et al.* (2005) and Zhu *et al.* (2013). Different studies from various countries have likewise utilized these sets of practices (e.g. Zhu *et al.*, 2008c; Zhu *et al.*, 2005; Zhu & Sarkis, 2006; Zhu, Sarkis, & Lai, 2007; Zhu *et al.*, 2011, Zhu *et al.*, 2010; Ninlawan *et al.*, 2010; Shang *et al.*, 2010; Zhu *et al.*, 2008b; Eltayeb *et al.*, 2011 & Rusli *et al.*, 2012). Internal practices involve those that can be composed, arranged, and executed inside the firm while external practices rely upon some collaboration from external parties, for example, suppliers and clients. GSCM practices that had been used in this study includes internal environmental management (IEM), green purchasing (GP), customer environmental cooperation (CEC), and reverse logistics (RL). With the employing GSCM in manufacturers' business activity, it can adapt to the forces from clients, purchasers, publics and government controllers who have expanding ecological concern. In any case, constant innovation is additionally required as vital answer for meet those encompassing forces.

2.1.1 Internal environmental management (IEM)

IEM is the act of integrating GSCM into a company's procedure and demonstrating their responsibility through top management vision, middle management inclusion, and reaching across all organizational members through the foundation of cross-utilitarian groups (Zhu *et al.*, 2008a). It indicates that IEM emphasis on the encouraging support and commitment from top management of the organization, and the existing of environmental management system or policy in organizing the business operation activities in more environmental manner. IEM is very important practice in GSCM because it seemed act as foundation for the whole GSCM change process (Calza *et al.*, 2017) that should be focused more by proactive companies to gain competitive advantage.

2.1.2 Green Purchasing (GP)

As stated by Zhu *et al.* (2008a), green purchasing mainly related to collaboration with suppliers to deliver environmental friendly products. In other words, green purchasing refers to the credential suppliers that comply with environmental management system and supplier collaboration with organisation in purchasing and acquiring process of environmentally friendly raw materials. GP is likewise characterized as deliberately arranged buying with the consciousness of environment-friendly necessities, for example, waste reduction and the

likelihood of reusing and recycling products (Jabbour *et al.*, 2015). In developing green product and in minimizing environmental problem during the production process, the environmentally-friendly raw materials and inputs are highly required.

2.1.3 Customer Environmental Cooperation (CEC)

Customer environmental cooperation can be described as the collaboration between customers and organisation in designing and developing environmentally friendly product which meets their environmental requirement and environmental regulation by sharing the idea, knowledge or technical information together (Zhu *et al.*, 2008a). In the present condition, organizations need to go past customary reasoning and recognize clients as key accomplices for coordinated efforts on greening issues (Calza *et al.*, 2017). CEC is the practice toward engaging customers from eco-design to distribution, including packaging and additionally the act of reclaiming the products (Vanchon & Klassen, 2006; Chan *et al.*, 2012; Bouzon *et al.*, 2018). Therefore, there is needed a long term trust-based relationship in order to communicate ongoing information and productively play out all procedures as specified above (Marshall *et al.*, 2015; Eltayeb *et al.*, 2011).

2.1.4 Reverse logistics (RL)

Reverse logistics is about the movement of products, materials, or packaging from customer or to suppliers (Carter & Ellram, 1998; Rogers & Tibben-Lembke, 2001; Alvarez-Gil *et al.*, 2007). Reverse logistics also refers to the process or activities after the final product is delivered to the end customers either collect it back from customers or is returned by customers in order to maintain the business' effectiveness and maintain natural environmental aspects including includes recycle, reuse, and remanufacturing. Reverse logistics is seemed to be an important GSCM practice that has gained serious attention among companies especially in the retail industry in handling the problem of returns (Hawks, 2006).

2.2 Green Innovation

The consideration of green innovation is turning into a hotly debated issue both in the practice and academic (Schiederig *et al.*, 2012). According to Oltra and Jean (2009), green innovation can be described as "innovations that consist of new or modified processes, practices, systems and products which benefit the environment and contribute to environmental sustainability". Chen *et al.* (2006) defined green innovation as hardware or software innovation in technology that is related to green products or process, consists of the innovation in technology like energy-saving, waste recycling, green product designs or corporate environmental management. The current study defines green innovation as a new environmental approach, idea, product, process or services that concern on minimizing negative environmental impact and also create differentiation of developed product among competitors. Green innovation can result in the lessening of ineffectiveness and the balanced utilization of natural resources, establishing a main source of cost reduction (Calza *et al.*,

2017). In addition, since raised customer mindfulness on the natural effect of utilization decisions, the environmental traits of new products and services also can be utilized for marketing differentiation (Orsato, 2006, Porter & Linde, 1995; Calza *et al.*, 2017). Green innovation can be classified into four types of innovations which are product innovation, process innovation, managerial innovation, and marketing innovation (Chen *et al.*, 2006; Porter & Linde, 1995; Reid & Miedzinski, 2008). Green innovation is planned to help the execution of GSCM keeping in mind the end goal to satisfy the prerequisite of environmental directives (Chen *et al.*, 2006). Firms need to generate innovation in both inside and outer environments of supply chain management and respond to natural issues (Chen *et al.*, 2008). This is additionally upheld by Porter and Linde (1995) who focuses on that organization in the dynamic and competitive surroundings need to innovate their products or services and in addition conforming to the forces from competitors, consumers, and regulation, and various pressures to survive. The innovation is fused of process and product, and ecological protection ideas into firms' product design and packaging keeping in mind the end goal to deliver product differentiation (Shrivastava, 1995; Chen, 2008). Further that, the increasing pressure from stakeholders has also become a critical driver to push companies to adopt green innovation as well as the implementation of GSCM.

2.2.1 Green product innovation (PD)

Green product innovation involves any novel and significantly improved product or service produced through reducing its whole environmental impact (Reid & Miedzinski, 2008). In general, the major environmental problems caused by most products arise from the use of the products themselves, such as fuel consumption and CO2 emissions of cars, and disposal of heavy metals in batteries instead of during the production of the products (Bernauer *et al.*, 2006). Indeed, product innovation generally focuses on decreasing environmental impact throughout a product's entire life cycle, starting from its root such as improved environmentally-friendly raw material and inputs.

2.2.2 Green process innovation (PC)

Green process innovation is defined as the development and application of preventive environmental technologies (Reid & Miedzinski, 2008), including significant changes in techniques, equipment, or software. Bernauer *et al.* (2006) use the term green process innovation to refer to the development in the production process that leads to the decrease of environmental impacts such as closed loops for solvents, material recycling, or filters.

2.2.3 Green managerial innovation

In terms of green innovation, managerial innovation consists of environmental management systems (EMS) or other specific environmental management tools such as process control tools, environmental audits, and chain management (Reid & Miedzinski, 2008). Green managerial innovation can be understood as an application of environmental business method

into the overall company system in order to decrease environmental impact. According to Bernauer *et al.* (2006), green managerial innovation does not decrease environmental impacts directly, but assists in the execution of technical green innovation in terms of process and product in companies.

2.2.4 Green marketing innovation

Green marketing innovation can be generally defined as a development of environmentally-friendly marketing procedure in company. Reid and Miedzinski (2008) stated that marketing innovation can be of great importance in the green innovation perspective. The activities involve incorporating environmental criteria into the product promotion such as voluntary eco-labelling, franchising, licensing, and pricing activities (Seman *et al.*, 2014). Green marketing innovation emphasises on the improvement of marketing practices of products such as packaging, placing, promotion, and pricing, in addition to increase the environmental performance of GSCM practices.

2.3 The Level of Adoption

Typically, adoption begins with the acknowledgment that a need exists and moves to looking for resolution, at that point to the underlying choice to endeavour the adoption of a solution lastly to the genuine choice to endeavour to continue with the implementation of the solution (Damanpour and Schneider 2006; Gallivan 2001; Mendel *et al.* 2008). In general, Cambridge Dictionary defines the word 'adoption' as an act of accepting or starting to use something new. Jayarathna (2017) straightforwardly defines adoption as what exactly degree do individuals apply new process or take after new practice. In conceptual context, Fishbein (1980) described the term adoption as a cognizant choice to execute another training or apply another new innovation. The term of adoption is also sometimes can be referred to the he consequences of procedures of decision making and behavior change (Parminter, 2011). Within this decision making process recipients can dismiss the change and look to re-start the past training or innovation (Parminter, 2011 & Fishbein, 1980). With a specific end goal to assess the level of adoption of GSCM practices and green innovation, it is noted that various studies utilized diverse stages of adoption (Eric, 2006 & William *et al.*, 1984). However, most of researchers used five stages of adoption to measure the adoption level (Ovwigho, 2007 & William *et al.*, 1984). Rogers (2003) stated that the innovation-decision process is the procedure through which an individual (or other decision-making unit unit) goes from first information of a development to framing a state of mind toward the innovation, to a choice to adopt or reject, to usage of the new idea, and to affirmation of this choice. Rogers (2003) then hypothesised five main steps in the innovation decision process include knowledge, persuasion, decision, implementation, and confirmation. These five stages are in accordance with the accompanying five phases (steps): awareness, interest, evaluation, trial, and adoption.

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3.0 METHODOLOGY

3.1 Sample of Study

The sample of this study was collected from the list of ISO 14001-certified manufacturing companies in Malaysia that is obtained from Federation of Malaysian Manufacturers (FMM) directory. The questionnaires based survey data was used and were sent to those in an Environmental Management Representative (EMR) position who are familiar with the green issues with business aspects namely supply chain and innovation in the manufacturing facilities. This study considers all the type business activity of Malaysian manufacturing and including the Malaysian full owned companies and foreigner-based companies. From the Figure 1, the majority of the respondents involved in this survey are by foreigners fully owned companies (67 or 54%) such as American-based, Japanese-based, European-based, Korean-based and Taiwanese-based. The figure also indicated most of business activities are operated by these foreigner-based companies that is led by type of electrical and electronics. Meanwhile, Malaysian fully owned companies only indicates about 56 or 46% from the selected sample of 123 manufacturing companies. From Figure1, it also illustrates that the allocation is quite diverse from electrical and electronics, chemicals, rubber, metals and machinery, automotive, plastics, and others. A majority of the respondents are from 'others' type of business activity such as aluminium, cement, oil and gas and so on which comprise of 37.4% of the total respondents, followed by the companies that have electrical and electronics type of business(24.4%). The least respondent comes from the rubber type business activity which constitutes only 4.1%.

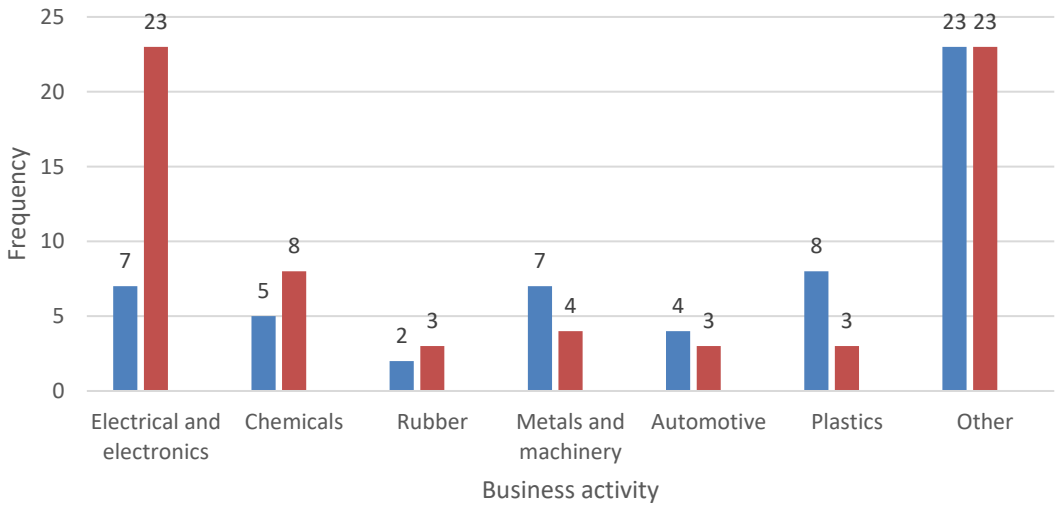

Figure 1: Sample of respondents

3.2 Questionnaire Development

To achieve the aims of this paper, the level of GSCM practices adoption is measured by 27 items based on the standard questionnaire used by numerous past studies (e.g. Zhu *et al.*, 2005; Eltayeb & Zailani, 2009; Carter *et al.*, 1998; Zhu & Sarkis, 2006; Carter and Ellram, 1998; Rogers & Tibben-Lembke, 2001; Ninlawan *et al.*, 2010; Shang *et al.*, 2010). GSCM practices consists of four main practices namely internal environmental management, green purchasing, customer environmental cooperation, and reverse logistics. Meanwhile, green innovation comprises of four major constructs namely green product innovation, green process innovation, green managerial innovation, and green marketing innovation with a total of 17 measurement items. With regard to evaluate the constructs of GSCM practices and green innovation practices, respondents were required to assess each question in terms of level of implementation of each practice in their company using five point likert scale (1- Not considering, 2- Planning to consider, 3- Considering it currently, 4- Initiating implementation, 5-Implimenting successfully). In the interest of the proposed scoring method of Schwartz *et al.* (2002) and Jayarathna (2017), summated value of is taken by adding individual scores of total items and that score can obtain any value as calculated as followed:

GSCM practices: 27 items
Value calculated for stage 1 and 5
27x1=27; 27x5=135

Green innovation practices: 17 items
Value calculated for stage 1and 5:
17x1=17, 17x5=85

For univariate analysis the range of GSCM practices (27-135) and green innovation practices (17-85) is sub divided into five levels as stated by Ovwigho (2007), Rogers (2003), Williams *et al.* (1984) as Table 1:

Table 1: Proposed of Stage of Adoption

Practices	Range	Stage of Adoption	No. of Stage
GSCM	27.0 – 48.5	Awareness	1
	48.6 – 70.1	Interest	2
	70.2 – 91.7	Evaluation	3
	91.8 – 113.3	Trial	4
	113.4 – 135.0	Adoption	5
Green innovation	17.0 – 30.5	Awareness	1
	30.6 – 44.1	Interest	2
	44.2 – 57.7	Evaluation	3
	57.8 – 71.3	Trial	4
	71.4 – 85.0	Adoption	5

4.0 DATA ANALYSIS AND RESULTS

In this study, the Predictive Analytics Software (PASW) version 18 (formerly SPSS statistics) was used to calculate the mean score value of the constructs, and also to test the reliability and validity of each construct. Table 2 shows the results of reliability and validity of the constructs which recognizes that the value of Cronbach's alpha, composite reliability and the average variance extracted (AVE) are higher than the required benchmarks characterized. Reliability analyses included Cronbach's alpha (α) and composite reliability. The values for Cronbach's alpha in this study were all over the limit of 0.7 (range, 0.710 to 0.946), demonstrating high internal consistency of the measurements. Additionally, the values for composite reliability all surpassed 0.7 in this study (range, 0.798 to 0.951), showing that the measures were solid. The AVE values in this study all surpassed the edge of 0.5 (range, 0.539 to 0.734), demonstrating that each measure construct had high convergent validity. By and large, the Cronbach's alpha, composite reliability and AVE value for the two constructs, GSCM practices and green innovation are over the rule of thumb and thus the constructs utilized in the study have confirmed to have construct reliability and convergent validity.

Table 2: Mean, Reliability and Validity

Constructs	Dimension	Mean	Composite Reliability		Cronbach's Alpha		AVE	
GSCM	IEM	4.18	0.921	0.798	0.898	0.926	0.661	0.565
	GP	3.47	0.931		0.916		0.604	
	CEC	3.42	0.900		0.864		0.606	
	RL	3.21	0.889		0.843		0.616	
Green Innovation	PD	4.07	0.826	0.800	0.719	0.918	0.547	0.734
	PC	4.22	0.849		0.765		0.589	
	MN	4.15	0.822		0.710		0.539	
	MR	3.80	0.920		0.890		0.696	

The mean score value of the constructs in Table 2 are reviewed to understand the level of implementation of GSCM practices and green innovation in Malaysian manufacturing companies. Figure 1 represents the level of implementation of GSCM practices and green innovation practices among manufacturing firms in Malaysia.

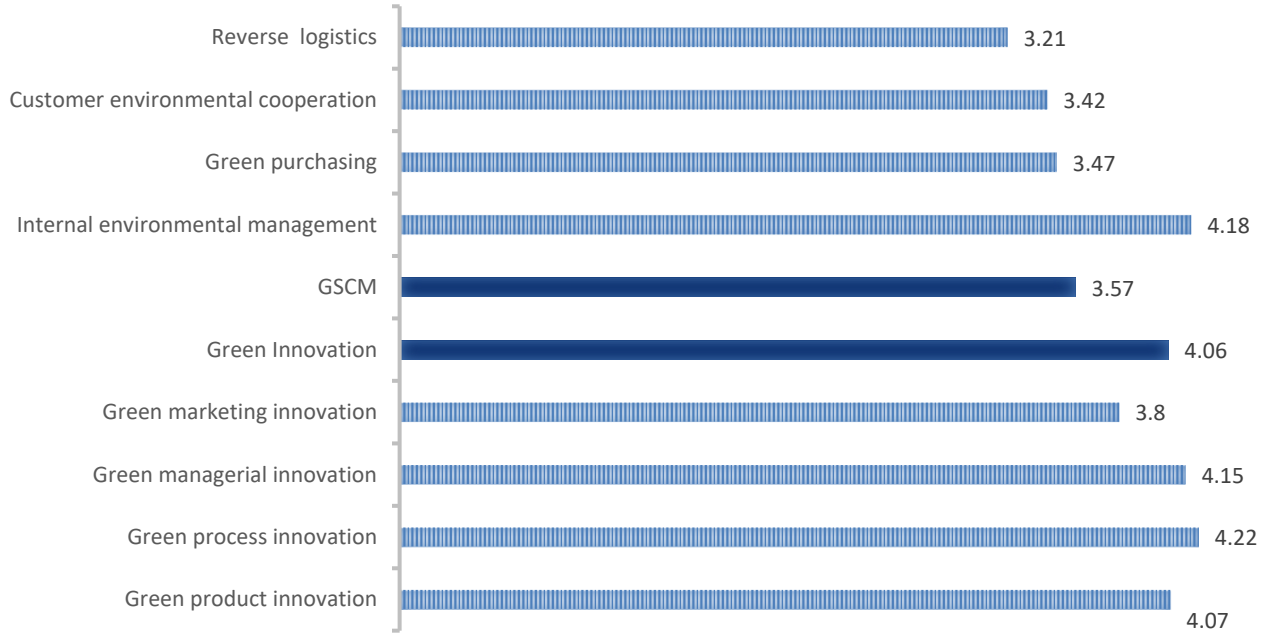

Figure 2: The implementation of GSCM practices and green innovation practices of manufacturing companies

Based on the Figure 2, by looking to each items individually, Malaysian manufacturing companies carry out GSCM practices with ranging from higher to some degree to relatively significant, with mean values consistently within the 3.00 and 4.00 ranges. Internal environmental management is the highest of GSCM practices with a mean value of 4.18. Besides GSCM practices' adoption rate lagged, with the lowest mean values of 3.21 is reverse logistics practice. By examining the mean score value of green innovation construct, Figure 2 illustrates the Malaysian manufacturing companies carry out to some degree of green innovation practices' adoption with mean values over 4.00 for the three green innovation factors namely green product innovation, green process innovation, and green managerial innovation; especially for green process innovation with the highest mean value of 4.22. Green managerial innovation is the second practice that adopted mostly by Malaysian manufacturing companies in green innovation. Green marketing innovation is indicated with the lowest mean value 3.80 in green innovation adoption.

Overall, the score of grand mean for GSCM practices is 3.57 which indicates that manufacturing companies in a position of currently considering these practices but almost to the initiating implementing. For green innovation, the grand mean value of 4.06 implies that the manufacturing companies in a good position which is initiating implementation. In order to provide general understanding of the level of adoption in GSCM and green innovation practices in Malaysia, the grand mean of both main constructs were analyzed. The level of GSCM practices adoption was evaluated by the summated value of the 27 items under four basic categories of GSCM practices, and the level of green innovation was evaluated by the

summated value of the 17 items under four practices. Adoption level was classified in to five stages as awareness, interest, evaluation, trial and adoption as proposed by Rogers (2003). According to Table 3, it can be concluded that manufacturing companies in Malaysia are in Trial level as parallel with the degree of likert scale.

Table 3: The Level of Adoption of GSCM Practices and Green Innovation

Practices	Overall Mean (a)	Summated Value of items (b)	Total (a x b)	Stage of Adoption (Refer Table 1)
GSCM	3.57	27	96.39	4- Trial
Green innovation	4.16	17	69.02	4- Trial

5.0 DISCUSSION

The purpose of this paper is determine the level of the adoption of GSCM and green innovation among manufacturing companies and also identifying which practice is mostly adopted by them. The mean score value of the GSCM and green innovation constructs are studied to understand the extent of the level of adoption of GSCM and green innovation practices in Malaysian Manufacturing companies. The mean value was analysed briefly in the previous section. Based on the result, this study found that manufacturing companies in Malaysia are currently considering all the practices of GSCM and green innovation and most of them have initiated implementation.

In determining the level of GSCM practices implementation, the GSCM practices are adopted across the supply chain which includes internal environmental management, green purchasing, customer environmental cooperation, and reverse logistics. Above all, internal environmental management (IEM) practices are relatively high with the mean score of 4.18 which clearly shows the concept that environmental management systems are generally implemented in Malaysian manufacturing organisations but are mostly restricted within the company and are yet to be established strongly across the supply chain. Meera and Chitramani (2014), Rusli *et al.* (2012), Zhu *et al.* (2010), Ninlawan *et al.* (2010), and Zhu *et al.* (2008) have also reported similar results which indicated the practice of internal environmental management was implemented at the highest level compared to the other GSCM practices that have been studied. For other GSCM practices, Malaysian manufacturing companies implement them at similar levels. Overall, by examining the mean score value, the results may specify that there is a gap between the surrounding pressures being considered by Malaysian organisation in Malaysian manufacturing companies and their adoption of GSCM practices, with a majority of results around the 'considering it currently' stages. It can be claimed that the manufacturing companies in Malaysian are still in the early learning stages of corporate environmental programs and practices. This overall result also indicates to the essential for Malaysian manufacturers to become better educated in GSCM

practices. Thus, the implementation of GSCM practices should be considered not just within the organisation but has to be extended to the supply chain for long-term environmental sustainability.

Regarding to the level of green innovation practices implementation, green innovation practices consist of green product innovation, green process innovation, green managerial innovation, and green marketing innovation that are adopted in Malaysian manufacturing companies. Most of all, green process innovation (4.22), green managerial innovation (4.15), and green product innovation (4.07) are heavily implemented in Malaysian manufacturing oganisations which clearly prove the basic concept of environmental innovation. Several studies on green innovation show similar results (Alhadid & Abu-Rumman, 2014; Chiou *et al.*, 2011; Weng *et al.*, 2015; Chang, 2011; Chen & Chang, 2011). Meanwhile, another green innovation practices namely green marketing innovation is relatively moderately adopted with the mean scores 3.80. This is not surprising that green marketing innovation practices are slightly adopted in Malaysian manufacturing companies because it is just proposed as new dimensions for green innovation in this study and still lack empirical studies on them in the green innovation context entirely. Therefore, Malaysian manufacturers should consider developing new opportunities and changes not only in their product, process, and management but also in their marketing and reverse logistics across the supply chain in accordance to the technological advancement along with stricter government regulation. The adoption of GSCM practices can be involved in the green innovation together in the process of product's life cycle besides minimising negative environmental impact thoroughly (Seman *et al.* 2012b). The researcher believes that bringing together the green innovation practices completely will become a key to survival and maintenance of manufacturing companies in improving and sustaining their capabilities and performance.

6.0 CONCLUSION

Emerging environmental issue over worldwide is driving companies to continuously enhance their green capabilities in their supply chain and implement innovative green practices to protect the environment performance. This study mainly examines the level of adoption of GSCM and green innovation practices in Malaysian manufacturing companies. The findings will help manufacturers to recognise which practice will lead to the highest impact of GSCM practices and green innovation implementation, and which practice needs further improvement. Through this analysis, manufacturing companies may be able to focus and make an improvement directly on the possible practice or item in order to improve GSCM and green innovation effectively. Thereby, the implementation of GSCM and green innovation should be considered not just with in the organization but has to be extended to the supply chain for long term environmental sustainability.

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