How to Cite:
Alsuraihi, A., Wahab, N. A., Noorizam, K. A. M., Masruki, R., & Ab Rahman, Z. (2022). The impact of green supply chain management practices on firm's competitive advantages. *International Journal of Health Sciences*, *6*(S4), 8801–8818.
https://doi.org/10.53730/ijhs.v6nS4.11336

The impact of green supply chain management practices on firm's competitive advantages

Alhussain Alsuraihi
Universiti Sains Islam Malaysia

Norailis Ab. Wahab
Universiti Sains Islam Malaysia
Corresponding author email: norailis@usim.edu.my

Khairul Affeiq Mohd. Noorizam
Universiti Sains Islam Malaysia

Rosnia Masruki
Universiti Sains Islam Malaysia

Ab Rahman, Z.
Research Centre for Theology & Philosophy, Faculty of Islamic Studies UKM
Bangi, Selangor, Malaysia
Email: zaizul@ukm.edu.my

***Abstract*---**Green supply chain management (GSCM) practices are cross-organizational and closed-loop. They aim to reduce the ecological impact of the firm's activity without sacrificing quality, cost, reliability, performance, or energy utilisation efficiency. This study presents empirical evidence to encourage firms to implement GSCM practices, which may enhance their competitive advantages. This study attempts to contribute to the growing research on GSCM practices—namely internal environmental management, green purchasing, eco-design and packaging, investment recovery, and cooperation with customers—and their effects on competitive advantages using a sample of 258 ISO 14001-certified manufacturing firms in Malaysia. A partial least squares structural equation modelling (PLS-SEM) analysis showed the direct effects of green purchasing, eco-design and packaging, investment recovery, and cooperation with customers directly on competitive advantages. However, internal environmental management did not relate to competitive advantages. Suggestions for future research are proposed. The study confirms the positive effects of GSCM practices on the

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
Manuscript submitted: 9 April 2022, Manuscript revised: 18 June 2022, Accepted for publication: 27 July 2022

competitive advantages of firms in the Malaysian manufacturing industry.

***Keywords*---**green supply chain management, competitive advantages, manufacturing firms.

Introduction

In the competitive global market, companies are developing new and improving current innovative methods to enhance their competitiveness. Some firms do so by improving their environmental performance in response to the growth of environmental regulations, to reduce the environmental impact of their services and products, and to address the environmental concerns of their customers (Bacallan, 2000; Jia & Wang, 2019). Green practices are one of the strategies for environmental improvement. They are operational initiatives adopted by many firms, including firms in Southeast Asia, to address environmental concerns (Rao & Holt, 2005).

Increased environmental concerns over the past decades, as demonstrated by government regulations and stronger public awareness to protect the environment, have pushed firms to take serious actions against environmental issues around the world (Taseer et al., 2018). Firms generally emit toxic waste into the environment during manufacturing (Ahmed et al., 2018). The term ‘green’ has been used to reflect and represent the environmental, economic, and social impact of the organisation’s activities (Rasit et al., 2019). Green supply chain management (GSCM) is an emerging field propelled by the need to be environmentally conscious.

Manufacturing firms are required to implement green practices in their supply chain management (SCM) activities. Some examples of these green practices are green purchasing, eco-design, reverse logistics, green marketing, green technology, and green manufacturing practices. The goal of these environmentally and socially accountable practices is to reduce the harmful impact of manufacturing and increase firm profitability (Khan, 2019). Green production practices and resources will reduce production costs, improve product quality, improve SCM efficiency, and eventually realise competitive advantage in the industry (Handfield et al., 1997). These practices aim to eliminate waste and improve the efficiency of firm manufacturing processes, thereby creating a positive impact on organisational performance and environmental effectiveness (Vanalle et al., 2017).

Adding value to the business and minimizing costs of the overall production system have been identified as key drivers to increase competitiveness in the global market (Moori et al., 2018). Many firms agree that common manufacturing objectives, such as delivery, cost, and flexibility, are no longer enough to stay competitive in the market and be innovative in terms of technology implementation, as external stakeholders require an increased focus on sustainability (Pinto et al., 2019). Therefore, it is necessary to investigate how the integration of environmental sustainability elements into the production system can lead to competitive advantage.

There is currently growing environmental awareness in Asia, and firms are under pressure from stockholders, customers, and the government to reduce eco-harmful activities (Luthra et al., 2016). Indeed, firms, especially those in the manufacturing sector, must incorporate sustainability elements in their activities and reduce end-to-end supply chain costs to achieve competitive advantage (Gunasekaran & Ngai, 2003; Qorri et al., 2018).

Afroz et al. (2019) stated that the implementation of green practices in Malaysia is lacking. To overcome these challenges and obstacles, they suggested that the government incentivise organisations that implement green practices. The Malaysian government has introduced tax incentives for manufacturing firms that implement green practices, such as pioneer status (PS) and investment tax allowance (ITA) (Singh, 2017). The aim of this study is to examine the effects of GSCM practices (internal environmental management, eco-design, green purchasing, cooperation with customers, and investment recovery) on the competitive advantages of ISO 14001-certified manufacturing firms in Malaysia.

Literature Review

Green Supply Chain Management Practices

GSCM practices are efforts undertaken by an organisation to minimise negative environmental impact during the entire life cycle of products or services, starting from the design, procurement of raw materials, use, and final disposal of the product (Khairani et al., 2017). In this study, GSCM practices are restricted to the activities of manufacturing firms in Malaysia, which are the largest contributor of environmental problems. Srivastava (2007) defined GSCM as the incorporation of environmental attributes into SCM processes (product and service design, procurement, manufacturing, distribution, and end of life product management) to gain sustainable competitive advantage. GSCM can help firms to be more sustainable in their operations. Moreover, the greening of industry will reduce environmental degradation.

The term 'green supply chain' or 'sustainable supply chain' means the integration of sustainable environmental process with the conventional supply chain. This process includes product design, supplier selection, materials procurement, distribution, product manufacturing and assembly, and end-of-life management (Khan et al., 2016). In addition to mitigating the harmful impact of businesses and supply chain operations, GSCM will also add or create value to the processes of the entire supply chain, thereby improving organisational performance. These additional values include less manufacturing waste, reduced manufacturing costs, reuse and recycling of products, positive image building, better asset efficiency, and greater customer satisfaction (Khan et al., 2018).

In recent years, local and global environmental issues have become a serious concern for business organisations. Economic consumption drives those organisations to utilise a high volume of materials and energy in their operations.

Business organisations, here, refer to manufacturing firms, which are believed to be the largest contributor to environmental issues (Beamon, 1999). SCM has grabbed the attention of industrialists globally because of the urgency for strategic planning in the maintenance, design, and operations of supply chain processes. SCM is the most important system of modern organisations. It is integrated with various operational stages to meet and satisfy market needs and maximise firm profits (Shafique et al., 2017; Suryanto et al., 2018; Villanueva & García, 2013). Despite the benefits of SCM, some manufacturing firms have overlooked its environmental, economic, and social impact, including global warming, health diseases, global energy crisis, and climate change (Suryanto et al., 2018).

GSCM has caught the attention of scholars because of its consideration of the environment and impact on organisational performance. Srivastava (2007) explained that GSCM includes green purchasing, green design, green distribution, green production, reverse logistics, and logistics marketing activities. Walker et al. (2008) stated that GSCM practices are applied in all stages of the product lifecycle, such as production, purchasing, distribution, use, and disposal. GSCM practices concern various activates, such as production, design, supply, assembly, packaging, logistics, and distribution (Eltayeb & Zailani, 2014; Handfield et al., 1997; Mohamad et al., 2018). Therefore, GSCM practices cover a broad scope. GSCM studies are limited by the researcher's objectives, as in the case of any SCM research (Zhu et al., 2008). This study focuses on the implementation of the following GSCM practices: internal environmental management, eco-design, green purchasing, cooperation with customers, and investment recovery.

Firm's Competitive Advantage

The concept of competitive advantage can be viewed from different perspectives, though the objective remains similar. Porter (1989) defined competitive advantage as the heart of the firm's performance in a competitive market. Porter identified two generic types of competitive advantage. The first is cost leadership, where the company obtains competitive advantage through the efficient use of capital and labour and by providing products at low cost. The second is differentiation, in which the firm creates unique features for its products or services through the use of new technologies for customer support (Porter & Linde, 1995). Competitive advantage fundamentally emerges from the value that a firm can create for its buyers that exceeds the firm's cost of creating it. Competitive advantage refers to a superior position in the marketplace that enables a firm to outperform its rivals (Porter, 1985).

Green awareness and environmental value are the main drivers for the implementation of GSCM that can enhance competitiveness (Tan & Shaharudin, 2016). Better environmental awareness has increased the demand for green products and services (Rao & Holt, 2005). Competitive advantage must be considered when investigating the relationship between GSCM practices and economic performance, seeing that competitive advantage is related to long-term efficiency and effectiveness (Laari et al., 2017). Environmental performance and competitive advantage are expected to positively influence economic performance.

Environmental competitiveness must be aligned with business performance, hence the organisation should have a broad perspective of competitiveness. Competitiveness at the level of organisation means its better capability to utilise its resources (efficiency) to achieve its goals (effectiveness) compared to its competitors (Dubey et al., 2017). It also refers to the uniqueness of a firm's product or service compared to that of other companies in the market (Flynn & Flynn, 1996; Porter, 1989). A firm can implement GSCM practices as part of its low cost and differentiation strategies in the supply chain to gain a competitive advantage over other organisations (Yang et al., 2013).

Wagner and Schaltegger (2004) examined the perspective of businesses on how environmental management can influence environmental competitiveness as a measure of economic performance. They found that the implementation of GSCM positively affects environmental performance and competitive advantage in terms of market opportunities, profitability, employee satisfaction, and risk reduction. Yang et al. (2010) measured manufacturing competitiveness (quality, cost, and delivery) and its relationship with customer and supplier management and continues development and improvement. Only cost and quality have a significant relationship towards competitive advantage. Therefore, the organisation's competitive advantage goes beyond quality products delivered on time.

Rao and Holt (2005) measured competitiveness and economic performance through improved quality, productivity, efficiency, and cost savings. The evidence from this study suggests that quality is the basic parameter that has to be met all the way. The present study will discuss competitive advantage using measures subsumed in three dimensions of price/cost, delivery, and quality (Ganeshkumar and Madan, 2015; Li et al., 2006; Tan & Shaharudin, 2016).

Green Supply Chain Management and Firm's Competitive Advantages

Environmental and social issues have become important issues in the business environment. Firms are also facing intensifying competition and increasing demand of stakeholders (Younis et al., 2019). Today's businesses are concerned about the environment because their operations potentially contribute to environmental degradation. Incorporating environmental elements into business operations can help organisations to create long-term values necessary for sustainability performance. The manufacturing industry in Malaysia is one of the main contributors to the country's pollution index (Hassan, 2016). As a result, GSCM practices have become a popular strategy in this sector to mitigate environmental issues while maintaining firm effectiveness and competitiveness. Furthermore, the Malaysian Economic Transformation Programme (ETP) has highlighted the urgency for green technology development so that Malaysian can achieve the developed nation status (Rasit et al., 2019).

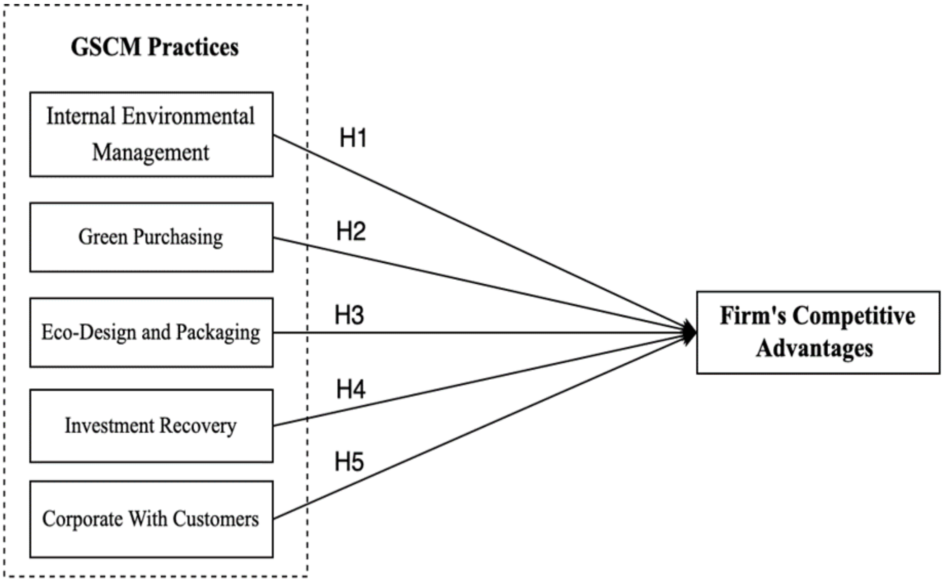
Jia and Wang (2019) measured competitive advantages as generic competitive advantages (quality, price flexibility of products, and new product features) and environmental competitive advantages (reduced environmental harm, avoidance of environmental risk, and environmental governance efforts). They found that the implementation of GSCM will improve the core competence of the organisation and bring corresponding advantages in terms of price, quality, and delivery.

Tracey et al. (1999) measured competitive advantage as seven dimensions: price offered, quality of products, order fill rate, order cycle time, order/shipment information, and frequency of delivery. Based on the above, the dimensions of competitive advantage selected in this study were quality, price/cost, and delivery.

Tan et al. (2016) studied the relationship between GSCM (green purchasing, green production, and investment recovery) and competitive advantages among 144 manufacturing firms in Malaysia. The study showed that green purchasing and green production influence firm competitiveness. Investment recovery has no relationship with firm competitiveness, perhaps because of the high cost of implementing the overall framework. The results appear to support the assumption that a firm's competitiveness will be greater with a higher level of green purchasing and green production practices. Organisations that implement green purchasing will balance between quality, cost/price, delivery, and environmental concept in its purchasing activities. Moreover, suppliers will be selected and evaluated based on green purchasing criteria to ensure that the procured materials contain green attributes. Such attributes provide added advantages for the organisation in their path towards global competitiveness.

GSCM practices—e.g., recycling, reuse, remanufacturing, eco-design and packaging, green purchase, reverse logistics, fewer waste, and disposal of products—are sources of competitive advantage. GSCM practices allow firms to differentiate themselves from other competitors through the use of inimitable resources (Wang, 2019). Therefore, GSCM and competitive advantage are determinants of firm performance, and the implementation of GSCM practices will enhance competitive advantage. A review of the literature indicates mostly positive relationships between GSCM practices and competitive advantage. This provides a strong support for the hypotheses of this study.

Hypothesis 1: *There is a positive relationship between internal environmental management and competitive advantage.*
Hypothesis 2: *There is a positive relationship between green purchasing and competitive advantage.*
Hypothesis 3: *There is a positive relationship between eco-design and packaging and competitive advantage.*
Hypothesis 4: *There is a positive relationship between investment recovery and competitive advantage.*
Hypothesis 5: *There is a positive relationship between cooperation with customers and competitive advantage.*



Source: Created by author

Figure 1: Conceptual Framework

Methodology

This study employed the quantitative approach to examine the impact of GSCM practices on competitive advantages. The research sample was manufacturing firms in Malaysia, specifically those certified with ISO 14001: environmental management system. ISO (2019) reported that there are 2,137 certified firms in Malaysia. According to Zailani et al. (2012) and Abdul-Rashid et al. (2017), ISO 14001-certified firms are more likely to adopt environmental initiatives, including green supply chain initiatives, resource recovery initiatives, and environmental design. Because of the Covid-19 pandemic, questionnaires were only distributed via email. In total, 600 questionnaires were sent to the manufacturing firms. The list of firms was gathered from the Federation of Malaysian Manufacturers (FMM) and Standard and Industrial Research Institute of Malaysia (SIRIM). A manager-level employee from the environment, health and safety, operations, quality, production, supply chain, or engineering department was requested to respond to the questionnaire. There were 258 returned and useable questionnaires, representing a response rate of 44.2%.

The hypotheses were tested using partial least squares structural equation modelling (PLS-SEM), run with the SmartPLS software (Ramayah et al., 2018). In addition, the Statistical Package for Social Science (SPSS) version 25.0 software was used to analyse the descriptive data. GSCM practices were measured using 26 items under five dimensions (internal environmental management, eco-design, green purchasing, cooperation with customers, and investment recovery) (Çankaya & Sezen, 2019; Eltayeb & Zailani, 2014; Green et al., 2012; Hyland & Gieskes, 2017; Scur & Barbosa, 2017; Seman et al., 2018; Shafique et al., 2017; Sundram et al., 2017; Zhu & Sarkis, 2007). Competitive advantages were measured using 14 items subsumed in three dimensions (price/cost, quality, and delivery) as a proxy of firm performance (Li et al., 2006b; Tan & Shaharudin, 2016). The items were measured on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Results

The respondent profile was summarised using basic descriptive statistics to present an overview of the sample. The majority of respondents were male (73.6%). Almost one-fourth of respondents (24.4%) were bachelor's degree holders, 7% held doctorate degrees, and 13.2% had other academic qualifications. Most firms (57.4%) had more than 251 employees, while 31.8% had 51 to 250 workers. The most represented industry was electrical and electronics (56.2%), followed by pharmaceutical (12.0%), chemical/petroleum (4.7%), food products and beverage (7.4%), textiles and textile products (4.7%), rubber and plastic (10.1%), and other industries (5.0%). Almost half of the sample firms have been in operation for more than 16 years (45.7%). Firms aged 11 to 15 years represented 31% of the sample, followed by those aged six to 10 years (24.4%) and less than 5 years (8.9%).

Measurement Model

Firstly, the reliability of the indicators (i.e., the observed variables) was examined. All item loadings were statistically significant, ranging between 0.753 and 0.902 (Table 1). Two items (IEM1 and GP1) were removed because their loadings were less than the critical value (> 0.7) (Hair et al., 2010). Secondly, the Cronbach's alphas, composite reliability, and average variance extracted (AVE) were acceptable because they were higher than their respective thresholds. According to Pallant (2020), a Cronbach's alpha of 0.7 is acceptable and above 0.8 is preferable. In this study, the Cronbach's alphas were above the cut-off point of 0.7, ranging between 0.851 to 0.910.

Hair et al. (2017) stated that a higher CR value means a higher level of reliability. The CR values in this study ranged from 0.894 to 0.953, which are regarded as good and satisfactory. The convergent validity, i.e., AVE, examines the extent to which indicators of a specific construct share common variance. In this research, the AVE values were acceptable because they were above the suggested critical value of 0.50 (Hair et al., 2010). The AVE values were between 0.629 and 0.740 as shown in Table 1. Therefore, convergent validity was established.

Table1: Item Loadings, Cronbach's alpha, CR, and AVE

Constructs	Item	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
Internal environmental management	IEM1	0.864	0.906	0.930	0.735
	IEM2	0.860			
	IEM3	0.835			
	IEM4	0.845			
	IEM5	Deleted			
	IEM6	0.855			
Green	GP1	Deleted	0.901	0.927	0.718

Purchasing	GP2	0.893			
	GP3	0.902			
	GP4	0.772			
	GP5	0.753			
	GP6	0.902			
Eco-Design and Packaging	EP1	0.836	0.892	0.921	0.699
	EP2	0.840			
	EP3	0.778			
	EP4	0.843			
	EP5	0.882			
Investment Recovery	IR1	0.812	0.884	0.919	0.740
	IR2	0.897			
	IR3	0.900			
	IR4	0.828			
Corporate With Customers	CC1	0.841	0.910	0.933	0.735
	CC2	0.876			
	CC3	0.857			
	CC4	0.863			
	CC5	0.851			
Cost/Price	SP1	0.857	0.944	0.953	0.718
	SP2	0.858			
	SP3	0.865			
	SP4	0.851			
Quality	QY1	0.802	0.852	0.894	0.629
	QY2	0.804			
	QY3	0.799			
	QY4	0.794			
	QY5	0.764			
Delivery	DY1	0.875	0.902	0.931	0.772
	DY2	0.877			
	DY3	0.876			
	DY4	0.886			

Key: IME: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PC: price/cost, QY: quality, DY: delivery.

Discriminant validity is the extent to which a construct is distinct from other constructs (Hair Jr et al., 2017). In this study, discriminant validity was verified using two criteria recommended by Hair Jr et al. (2017), namely cross-loadings and Fornell-Larcker criterion as presented in Table 2. The Fornell-Larcker criterion states that the square root of the AVE of each construct should be higher than its highest correlation with any other constructs (Chin, 1998; Fornell & Larcker, 1981). Table 2 shows that the square roots of the AVE of the latent variables ranged from 0.793 to 0.879, which were higher than the inter-construct correlations.

Table 2: Discriminant validity: Fornell-Larcke criterion

	CC	EP	GP	IEM	IR	MI	OI	PSI	PTI
CC									
EP	0.350								
GP	0.430	0.495							
IEM	0.295	0.400	0.416						
IR	0.411	0.477	0.547	0.313					
MI	0.354	0.393	0.571	0.427	0.535				
OI	0.261	0.231	0.329	0.212	0.160	0.165			
PSI	0.293	0.264	0.398	0.257	0.265	0.255	0.485		
PTI	0.169	0.379	0.401	0.155	0.309	0.274	0.444	0.489	
SP	0.294	0.410	0.399	0.412	0.341	0.419	0.428	0.550	0.387

	CC	DY	EP	GP	IEM	IR	PC	QY
CC	0.858							
DY	0.107	0.879						
EP	0.324	0.290	0.836					
GP	0.407	0.327	0.459	0.847				
IEM	0.283	0.176	0.368	0.395	0.852			
IR	0.386	0.220	0.446	0.522	0.301	0.860		
PC	0.360	0.223	0.374	0.316	0.275	0.302	0.847	
QY	0.442	0.233	0.389	0.391	0.237	0.406	0.371	0.793

Key: IME: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PC: price/cost, QY: quality, DY: delivery.

The second method to assess discriminant validity was cross-loadings, which means that the items should load more strongly on their own constructs. Table 3 shows that the cross-loadings criteria were fulfilled because the loadings of all items on their respective constructs were higher than their cross-loadings. Therefore, the measurement model satisfied discriminant validity.

Table 3: Discriminant validity: cross-loadings method

	CC	DY	EP	GP	IEM	IR	PC	QY
CC01	0.841	0.060	0.224	0.285	0.150	0.325	0.216	0.313
CC02	0.876	0.151	0.362	0.472	0.352	0.393	0.401	0.447
CC03	0.857	0.123	0.284	0.322	0.242	0.325	0.352	0.333
CC04	0.863	0.071	0.234	0.303	0.250	0.290	0.277	0.400
CC05	0.851	0.036	0.262	0.331	0.185	0.307	0.265	0.386
DY01	0.077	0.875	0.240	0.245	0.128	0.195	0.215	0.169
DY02	0.115	0.877	0.331	0.380	0.253	0.230	0.205	0.256
DY03	0.092	0.876	0.265	0.267	0.165	0.200	0.154	0.180
DY04	0.091	0.886	0.180	0.251	0.070	0.147	0.208	0.210
EP01	0.323	0.246	0.836	0.445	0.318	0.419	0.356	0.366
EP02	0.231	0.262	0.839	0.342	0.323	0.317	0.290	0.320
EP03	0.222	0.214	0.778	0.280	0.233	0.333	0.262	0.305
EP04	0.280	0.196	0.843	0.384	0.304	0.352	0.250	0.279

EP05	0.289	0.289	0.882	0.443	0.349	0.430	0.391	0.352
GP02	0.410	0.335	0.435	0.893	0.329	0.513	0.314	0.389
GP03	0.384	0.349	0.491	0.902	0.405	0.514	0.284	0.414
GP04	0.260	0.221	0.270	0.772	0.253	0.349	0.185	0.227
GP05	0.219	0.191	0.299	0.753	0.272	0.281	0.183	0.163
GP06	0.406	0.259	0.404	0.902	0.385	0.500	0.339	0.398
IEM01	0.196	0.094	0.308	0.282	0.863	0.192	0.195	0.139
IEM02	0.326	0.256	0.381	0.496	0.860	0.391	0.321	0.304
IEM03	0.203	0.185	0.309	0.282	0.835	0.231	0.273	0.189
IEM04	0.265	0.101	0.249	0.285	0.845	0.191	0.170	0.186
IEM06	0.187	0.077	0.297	0.281	0.855	0.229	0.184	0.153
IR01	0.222	0.054	0.220	0.261	0.143	0.812	0.152	0.216
IR02	0.424	0.240	0.453	0.552	0.289	0.897	0.312	0.436
IR03	0.367	0.255	0.470	0.533	0.295	0.900	0.282	0.372
IR04	0.269	0.154	0.328	0.375	0.275	0.828	0.260	0.324
PC01	0.411	0.244	0.474	0.381	0.344	0.364	0.837	0.429
PC02	0.259	0.171	0.230	0.225	0.153	0.235	0.862	0.284
PC03	0.250	0.147	0.275	0.236	0.265	0.230	0.848	0.273
PC04	0.290	0.210	0.306	0.257	0.212	0.218	0.832	0.225
PC05	0.296	0.168	0.277	0.225	0.178	0.217	0.854	0.339
QY01	0.357	0.202	0.310	0.333	0.260	0.254	0.369	0.802
QY02	0.377	0.197	0.328	0.260	0.151	0.360	0.301	0.804
QY03	0.343	0.160	0.282	0.302	0.235	0.358	0.328	0.799
QY04	0.349	0.196	0.302	0.294	0.160	0.311	0.189	0.794
QY05	0.326	0.171	0.321	0.362	0.120	0.329	0.269	0.764

Key: IME: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PC: price/cost, QY: quality, DY: delivery.

Structural Model Assessment

After verifying that the measurement model was reliable and valid, the next step was to assess the structural or inner model. This assessment evaluates the quality of the structural model and tests the hypotheses (Hair Jr et al., 2017). In PLS-SEM, path coefficients and R^2 values are used to assess a structural model. R^2 is the amount of variance in the endogenous variable (dependent variable) explained by the exogenous variables (independent variables). The R^2 of the main target constructs should be high. The minimum acceptable value of R^2 proposed by Falk and Miller (1992) is 0.19. Chin (1998) proposed that R^2 values of 0.67, 0.33, and 0.19 can be considered as substantial, moderate, and weak, respectively. The structural model assessment indicated that the R^2 of firm competitiveness was 0.393, which means that 39% of the variance in firm competitiveness can be explained by the exogenous variables (see Table 4).

Table 0: R^2 of Endogenous Latent Variable

Construct	R^2	Result	
		Cohen (1988)	Chin (1998)
Competitive advantages	0.393	Substantial	Moderate

Table 5 shows the results of the hypotheses testing. H1 was not supported because internal environmental management was not found to be significantly related to competitive advantages, $\beta = 0.068$, $t = 1.163$, $p < 0.244$. Green purchasing significantly predicted competitive advantages, $\beta = 0.175$, $t = 3.062$, $p < 0.002$, hence H2 was supported. H3 was supported as there was a positive and significant relationship between eco-design and packaging and competitive advantages, $\beta = 0.261$, $t = 4.934$, $p < 0.000$. Similarly, investment recovery was found to significantly influence competitive advantages, $\beta = 0.123$, $t = 2.167$, $p < 0.030$. Therefore, H4 was supported. The final hypothesis was also supported, since cooperation with customers had a positive and significant effect on competitive advantages, $\beta = 0.223$, $t = 4.366$, $p < 0.000$. In summary, H2-H5 were supported.

Table 5: Hypothesis Testing Results

	Relationship	Std Beta	Mean (M)	Std Error	T-value	P-values	Decision
H1	IEM→CA	0.068	0.072	0.058	1.164	0.244	Not Supported
H2	GP→CA	0.175	0.173	0.057	3.062	0.002	Supported
H3	EP→CA	0.261	0.260	0.052	4.934	0.000	Supported
H4	IR→CA	0.123	0.122	0.057	2.167	0.030	Supported
H5	CC→CA	0.223	0.227	0.051	4.366	0.000	Supported

Key: IEM: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, CA: competitive advantages.

Conclusion

This study has identified GSCM practices that significantly improve the competitive advantages of manufacturing firms in Malaysia. This study examined the effects of five GSCM practices (internal environmental management, green purchasing, eco-design and packaging, investment recovery and cooperation with customers) on firm's competitive advantages. The statistical results supported most of the hypothesised relationships. The results showed that four practices—green purchasing, eco-design and packaging, investment recovery, and cooperation with customers—were significantly related to firm's competitive advantages. On the other hand, internal environmental management had no significant effect on competitive advantages.

The findings of this study can help managers to utilise their resources and communicate or involve their suppliers in a more effective way. Implementing more green practices can enhance firm competitiveness. Manufacturing firms that practice 'reuse, reduce, recycle' (3Rs) can save materials and total production costs. In turn, the firm's production will be more efficient, leading to its better competitive advantage.

Based on these findings, managers of manufacturing firms in Malaysia can set up strategies to promote GSCM, which may enhance the manufacturing process and enable the firms to gain competitive advantages over other competitors. The results can be also useful to support the green movement of the Malaysian manufacturing industry. Embracing green principles can help manufacturing firms to achieve better financial outcomes and eventually assist Malaysia to accomplish the Twelfth Malaysia Plan 2021- 2025. GSCM practices will contribute long-term to the financial performance of the firm.

Acknowledgement

This paper is a part of a research project that received financial support from the Ministry of Higher Education Malaysia through Fundamental Research Grant Scheme (FRGS/1/2019/SS01/USIM/02/3).

References

Ab Rahman, Z., (2021). Motivational Factors Of Muslim Rape Offenders In Sungai Udang Prison, Melaka, Malaysia. International Journal of Islamic Thought (IJIT),20(1),pp.156-165.DOI: 10.24035/IJIT.20.2021.219, 22321314

Ab Rahman, Z., Abdullah, S.N.H.S., Sudin, M.N., Shaari, A.H., Sarnon, N.B. (2018). The Relationship of Islamic Cognitive Reasoning Elements and Islamic Psychosocial as Pillars in The Self Empowerment of Risky Teenagers. International Journal of Civil Engineering and Technology (IJCIET). IAEME Publication. 9(9), 1104-1112.

Ab Rahman, Z., Ahmad Yunus Mohd Noor, Muhammed binYusof, Shahrulanuar bin Mohamed, Kashim, M.I.A.M (2019). Influence of Prayers Coping in Problematic Behaviors. International Journal of Civil Engineering and Technology (IJCIET). IAEME Publication. 9(9), 826-835.

Ab Rahman, Z., Awang, J., Ibrahim, M., Mohd Haidhar, K., binYusof, M., Kadir, F. A. A. & Mohamed, S. B., (2018). Element of Silent Repetition of Prayers and Self-Reflection or Introspection Approaches in Coping Problematic Behaviors among Adolescents. International Journal of Civil Engineering and Technology. 9 (7), 261-268.

Ab Rahman, Z., Awang, J., Noor, A.Y.M., Khairuddin, W.H., Ramli, Y.M. (2018). Factor of Religiosity Practices and Islamic Mental-Cognitive Process in Adolescents' At Risk In Bangi. International Journal of Civil Engineering and Technology (IJCIET). IAEME Publication. 9(8), 1140-1145.

Ab Rahman, Z., Kashim, M.I.A.M., Mohd Noor, A.Y.*, Che Zarrina Saari, Ahmad Zaki Hasan, Abdul Rahim Ridzuan, Abdul Rauf Ridzuan, Hanizah Mohd Yusoff, Wan Haslan Khairuddin (2020). Critical Review Of Positive Behavior And Resilience In Islamic Perspective During The Covid 19 Pandemic. Journal Of Critical Reviews, 7(5): 1117-1125 Doi: 10.31838/Jcr.07.05.216

Ab Rahman, Z., Kashim, M.I.A.M., Mohd Noor, A.Y., Saari, C.Z., Hasan, A.Z., Ridzuan, A.R., ..., Khairuddin, W.H. (2020), Critical Review Of Positive Behavior And Resilience In Islamic Perspective During The Covid 19 Pandemic Journal Of Critical Reviews, 7(5), Pp. 1117-1125.

Ab Rahman, Z., Kashim, M.I.A.M., Mohd Noor, A.Y., Saari, C.Z., Hasan, A.Z., Ridzuan, A.R., ..., Norhayati Rafida, A.R. (2020). Critical Review Of Religion In Coping Against The Covid-19 Pandemic By Former Covid-19 Muslim Patients In Malaysia Journal Of Critical Review, 7(5), Pp. 1145-1154.

Ab Rahman, Z., Mohd Noor, A.Y., Kashim, M.I.A.M., Hasan, A.Z., Saari, C.Z., Ridzuan, A.R., ..., Hussien, H.S. (2020). Critical Review Of Reciting Al-Quran In Restoring The Resilience And Mental Health Among Quarantined Covid-19 Patients Journal Of Critical Reviews, 7(5), Pp. 1126-1135.

Ab Rahman, Z., Mohd Noor, A.Y., Kashim, M.I.A.M., Saari, C.Z., Hasan, A.Z., Pa'ad, N.S., ..., (2020). Critical Review Of The Relationship Between Resilience, Self-Esteem And Religiosity Among The Tabligh During The Fight Of Covid-19, Journal Of Critical Review, 7(5), Pp. 1136-1144.

Abdul Rehman Khan, S. (2019). Introductory Chapter: Introduction of Green Supply Chain Management. *Green Practices and Strategies in Supply Chain Management*, *i*(tourism), 1–11. https://doi.org/10.5772/intechopen.81088

Abdul-Rashid, S. H., Sakundarini, N., Raja Ghazilla, R. A., & Thurasamy, R. (2017). The impact of sustainable manufacturing practices on sustainability performance. *International Journal of Operations & Production Management*, *37*(2), 182–204. https://doi.org/10.1108/IJOPM-04-2015-0223

Afroz, R., Rahman, A., Muhibbullah, M., & Morshed, N. (2019). Malaysian automobile industry and green supply chain management. *International Journal of Recent Technology and Engineering*, *7*(6), 158–162.

Ahmad Faizuddin Ramli, Jaffary Awang, Ab Rahman, Z. (2020). Buddhism According To Modern Muslim Exegetes, International Journal Of Islam In Asia Lain-Lain: Brill, 1 (2020) Pp. 1–18 Doi:10.1163/25899996-01010004

Ahmad Faizuddin Ramli, Jaffary Awang, Ab Rahman, Z. (2020). Identifying Islamophobia In Malaysian Buddhist Context Al-Itqan: Journal Of Islamic Sciences And Comparative Studies (Al-Itqān), 4 (2) Pp. 85-108.

Ahmed, W., Ahmed, W., & Najmi, A. (2018). Developing and analyzing framework for understanding the effects of GSCM on green and economic performance: Perspective of a developing country. *Management of Environmental Quality: An International Journal*, *29*(4), 740–758. https://doi.org/10.1108/MEQ-11-2017-0140

Bacallan, J. J. (2000). Greening the supply chain. *Business and Environment*, *6*(5), 11–12.

Beamon, B. M. (1999). Designing the green supply chain. *Logistics Information Management*, *12*(4), 332–342. https://doi.org/10.1108/09576059910284159

Çankaya, S. Y., & Sezen, B. (2019). Effects of green supply chain management practices on sustainability performance. *Journal of Manufacturing Technology Management*, *30*(1), 98–121. https://doi.org/10.1108/JMTM-03-2018-0099

Chin, W. W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, *22(1)*, 7–16.

Dubey, R., Gunasekaran, A., & Papadopoulos, T. (2017). Green supply chain management: theoretical framework and further research directions. *Benchmarking*, *24*(1), 184–218. https://doi.org/10.1108/BIJ-01-2016-0011

Eltayeb, T. K., & Zailani, S. (2014). Going Green through Green Supply Chain Initiatives Toward Environmental Sustainability. *Operations and Supply Chain Management: An International Journal*, *December 2019*, 93. https://doi.org/10.31387/oscm040019

Falk, R., & Miller, N. B. (1992). A primer for soft modelling. *Open Journal of Business and Management*.

Flynn, E. J., & Flynn, B. B. (1996). Achieving simultaneous cost and differentiation competitive advantages through continuous improvement: world class manufacturing as a competitive strategy. *Journal of Managerial Issues*, 360–379.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1). https://doi.org/10.2307/3151312

Ganeshkumar, C., & Madan, M. G. (2015). Green Supply Chain Initiatives of Manufacturing Firms: Complementary Versus Trade-Off. *ICTACT Journal on Management Studies*, *01*(02), 53–62. https://doi.org/10.21917/ijms.2015.0009

Green, K. W., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management*, *17*(3), 290–305. https://doi.org/10.1108/13598541211227126

Gunasekaran, A., & Ngai, E. W. T. (2003). The successful management of a small logistics company. *International Journal of Physical Distribution & Logistics Management*, *33*(9), 825–842. https://doi.org/10.1108/09600030310503352

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis: a global perspective, Upper Saddle River, N. *J: Pearson Education*.

Handfield, R. B., Walton, S. V, Seegers, L. K., & Melnyk, S. A. (1997a). "Green" value chain practices in the furniture industry. *Journal of Operations Management*, *15 VN-r*(4), 293–315.

Handfield, R. B., Walton, S. V, Seegers, L. K., & Melnyk, S. A. (1997b). "Green" value chain practices in the furniture industry. *Journal of Operations Management*, *15 VN-r*(4), 293–315.

Hassan, M. G. (2016). *The Impact of Social Well-being on Sustainability Practice among Malaysian Manufacturing Firms*. *October*, 863–870. https://doi.org/10.15405/epsbs.2016.08.121

Hyland, P., & Gieskes, J. (2017). Green supply chain management practices and performance: the role of firm-size for emerging economies. In *Journal of Manufacturing Technology Management* (Vol. 15, Issue 4).

ISO. (2019). 2018 Survey Results - ISO certification to various management systems Worldwide ISO Certification Survey – 2018. *Management System Statistics*, *2018*, 1–15.

Jia, X., & Wang, M. (2019a). The Impact of Green Supply Chain Management Practices on Competitive Advantages and Firm Performance. In X. Liu (Ed.), *Environmental Sustainability in Asian Logistics and Supply Chains* (pp. 121–134). Springer Singapore. https://doi.org/10.1007/978-981-13-0451-4_7

Jia, X., & Wang, M. (2019b). The Impact of Green Supply Chain Management Practices on Competitive Advantages and Firm Performance. In X. Liu (Ed.), *Environmental Sustainability in Asian Logistics and Supply Chains* (pp. 121–134). Springer Singapore. https://doi.org/10.1007/978-981-13-0451-4_7

Khairani, N. S., Kasim, E. S., Rajamanoharan, I. D., & Misman, F. N. (2017). Green supply chain management in the Malaysian automotive industry: A systems thinking perspective. *International Journal of Supply Chain Management*, *6*(2), 38–48.

Khan, S. A. R., Qianli, D., & Zhang, Y. (2016). Research on the measuring performance of green supply chain management: In the perspective of China. *International Journal of Engineering Research in Africa*, *27*, 167–178. https://doi.org/10.4028/www.scientific.net/JERA.27.167

Laari, S., Töyli, J., & Ojala, L. (2017). Supply chain perspective on competitive strategies and green supply chain management strategies. *Journal of Cleaner Production*, *141*, 1303–1315. https://doi.org/10.1016/j.jclepro.2016.09.114

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Subba Rao, S. (2006a). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, *34*(2), 107–124. https://doi.org/10.1016/j.omega.2004.08.002

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Subba Rao, S. (2006b). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, *34*(2), 107–124. https://doi.org/10.1016/j.omega.2004.08.002

Luthra, S., Garg, D., & Haleem, A. (2016). The impacts of critical success factors for implementing green supply chain management towards sustainability: An empirical investigation of Indian automobile industry. *Journal of Cleaner Production*, *121*, 142–158. https://doi.org/10.1016/j.jclepro.2016.01.095

Mohamad, M. N., Samuel, C., & Koilpillai, S. (2018). *The Influence of Green Supply Chain Practices towards Environmental Development : The Malaysian ISO14001 Certified Manufacturing Companies Perspective*. *2018*. https://doi.org/10.5171/2018.497926

Moori, R. G., Shibao, F. Y., & Dos Santos, M. R. (2018). Role of technology in the environmental performance of the Brazilian chemical industry. *Revista de Administracao Mackenzie*, *19*(1). https://doi.org/10.1590/1678-6971/eRAMR180094

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Routledge.

Pinto, M. M. A., Kovaleski, J. L., Yoshino, R. T., & Pagani, R. N. (2019). Knowledge and technology transfer influencing the process of innovation in Green Supply Chain Management: A multicriteria model based on the DEMATEL method. *Sustainability (Switzerland)*, *11*(12). https://doi.org/10.3390/SU11123485

Porter, M. E. (1989). How competitive forces shape strategy. In *Readings in strategic management* (pp. 133–143). Springer.

Porter, M. E., & Linde, C. van der. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *Journal of Economic Perspectives*, *9*(4), 97–118. https://doi.org/10.1257/jep.9.4.97

Qorri, A., Mujkić, Z., Gashi, S., & Kraslawski, A. (2018). Green Supply Chain Management Practices and Company Performance: A Meta-analysis approach. *Procedia Manufacturing*, *17*, 317–325. https://doi.org/10.1016/j.promfg.2018.10.052

Rao, P., & Holt, D. (2005a). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. https://doi.org/10.1108/01443570510613956

Rao, P., & Holt, D. (2005b). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916. https://doi.org/10.1108/01443570510613956

Rasit, Z. A., Zakaria, M., Hashim, M., Ramli, A., & Mohamed, M. (2019a). Green Supply Chain Management (GSCM) practices for sustainability performance: An empirical evidence of Malaysian SMEs. *International Journal of Financial Research*, *10*(3), 371–379. https://doi.org/10.5430/ijfr.v10n3p371

Rasit, Z. A., Zakaria, M., Hashim, M., Ramli, A., & Mohamed, M. (2019b). Green Supply Chain Management (GSCM) practices for sustainability performance:

An empirical evidence of Malaysian SMEs. *International Journal of Financial Research*, *10*(3), 371–379. https://doi.org/10.5430/ijfr.v10n3p371

Rehman Khan, S. A., Zhang, Y., Anees, M., Golpîra, H., Lahmar, A., & Qianli, D. (2018). Green supply chain management, economic growth and environment: A GMM based evidence. *Journal of Cleaner Production*, *185*, 588–599. https://doi.org/10.1016/j.jclepro.2018.02.226

Scur, G., & Barbosa, M. E. (2017). Green supply chain management practices: Multiple case studies in the Brazilian home appliance industry. *Journal of Cleaner Production*, *141*(September 2016), 1293–1302. https://doi.org/10.1016/j.jclepro.2016.09.158

Seman, N. A. A., Zakuan, N., Rashid, U. K., Nasuredin, J., & Ahmad, N. (2018). The Level of Adoption of Green Supply Chain Management and Green Innovation in Malaysian Manufacturing Industries. *International Journal of Research*, *05*(20), 1556–1575.

Shafique, M., Asghar, M., & Rahman, H. (2017). The Impact of Green Supply Chain Management Practices on Performance: Moderating Role of Institutional Pressure with Mediating Effect of Green Innovation. *Business, Management and Education*, *15*(1), 91–108. https://doi.org/10.3846/bme.2017.354

Singh, J. (2017). *Malaysia Corporate - Tax credits and incentives*. PWC Malaysia. https://taxsummaries.pwc.com/malaysia/corporate/tax-credits-and-incentives

Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, *9*(1), 53–80. https://doi.org/10.1111/j.1468-2370.2007.00202.x

Sundram, V. P. K., Bahrin, A. S., Othman, A. A., & Munir, Z. A. (2017). Green supply chain management practices in Malaysia manufacturing industry. *International Journal of Supply Chain Management*, *6*(2), 89–95.

Suryanto, T., Haseeb, M., & Hartani, N. H. (2018). *The Correlates of Developing Green Supply Chain Management Practices : Firms Level Analysis in Malaysia*. *October*.

T. Ramayah, Hwa, C. J., Chuah, F., & Ting, H. (2018). *Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0: An Updated and Practical Guide to Statistical Analysis (Second Edition ed.)*. https://www.researchgate.net/publication/341357609

Tan, C. L., Zailani, S. H. M., Tan, S. C., & Shaharudin, M. R. (2016). The impact of green supply chain management practices on firm competitiveness. *International Journal of Business Innovation and ResearchHTMT*, *11*(4), 539–558. https://doi.org/10.1504/IJBIR.2016.10000227

Taseer, M. I., Waseer, W. A., & Athar, M. A. (2018). *Ecological Aspect of Green Supply Chain Management a Framework of Manufacturing Industry*. *9*(1), 734–747.

Tracey, M., Vonderembse, M. A., & Lim, J. S. (1999). Manufacturing technology and strategy formulation: Keys to enhancing competitiveness and improving performance. *Journal of Operations Management*, *17*(4), 411–428. https://doi.org/10.1016/S0272-6963(98)00045-X

Vanalle, R. M., Ganga, G. M. D., Godinho Filho, M., & Lucato, W. C. (2017). Green supply chain managementAn investigation of pressures, practices, and performance within the Brazilian automotive supply chain. *Journal of Cleaner Production*, *151*, 250–259. https://doi.org/10.1016/j.jclepro.2017.03.066

Villanueva, R., & García, J. L. (2013). *Green Supply Chain Management; a competitive advantage. October.*
Wagner, M., & Schaltegger, S. (2004). The effect of corporate environmental strategy choice and environmental performance on competitiveness and economic performance: An empirical study of EU manufacturing. *European Management Journal*, *22*(5), 557–572. https://doi.org/10.1016/j.emj.2004.09.013
Walker, H., Di Sisto, L., & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, *14*(1), 69–85. https://doi.org/10.1016/j.pursup.2008.01.007
Wang, C. H. (2019). How organizational green culture influences green performance and competitive advantage: The mediating role of green innovation. *Journal of Manufacturing Technology Management*, *30*(4), 666–683. https://doi.org/10.1108/JMTM-09-2018-0314
Widana, I.K., Sumetri, N.W., Sutapa, I.K., Suryasa, W. (2021). Anthropometric measures for better cardiovascular and musculoskeletal health. *Computer Applications in Engineering Education*, *29*(3), 550–561. https://doi.org/10.1002/cae.22202
Yang, C. L., Lin, S. P., Chan, Y. hui, & Sheu, C. (2010). Mediated effect of environmental management on manufacturing competitiveness: An empirical study. *International Journal of Production Economics*, *123*(1), 210–220. https://doi.org/10.1016/j.ijpe.2009.08.017
Yang, C. S., Lu, C. S., Haider, J. J., & Marlow, P. B. (2013). The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. *Transportation Research Part E: Logistics and Transportation Review*, *55*, 55–73. https://doi.org/10.1016/j.tre.2013.03.005
Younis, H., Sundarakani, B., & O'Mahony, B. (2019). Green Supply Chain Management and Corporate Performance: Developing a Roadmap for Future Research Using a Mixed Method Approach. *IIMB Management Review*, *February 2020*. https://doi.org/10.1016/j.iimb.2019.10.011
Zailani, S., Jeyaraman, K., Vengadasan, G., & Premkumar, R. (2012). Sustainable supply chain management (SSCM) in Malaysia: A survey. *International Journal of Production Economics*, *140*(1), 330–340. https://doi.org/10.1016/j.ijpe.2012.02.008
Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18–19), 4333–4355. https://doi.org/10.1080/00207540701440345
Zhu, Q., Sarkis, J., Lai, K. H., & Geng, Y. (2008). The role of organizational size in the adoption of green supply chain management practices in China. *Corporate Social Responsibility and Environmental Management*, *15*(6), 322–337. https://doi.org/10.1002/csr.173