How to Cite:
Alsuraihi, A., Wahab, N. A., Noorizam, K. A. M., Masruki, R., & Rahman, A. Z. (2022). The mediating role of technological innovation on the relationship between green supply chain management and social performance. *International Journal of Health Sciences*, *6*(S6), 6358–6379. https://doi.org/10.53730/ijhs.v6nS6.11331

The mediating role of technological innovation on the relationship between green supply chain management and social performance

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---Malaysia is currently seeing significant environmental pollution caused by manufacturing and export activities and heavily affecting the economy, society, and environment. This issue calls for investigation on how environmental sustainability, through technological innovation, can be integrated into current production operations to create a closed-loop system, thereby enhancing social performance. Green supply chain management (GSCM) is gaining attention because of increasing environmental deterioration, such as overflowing landfills, depletion of raw materials, and pollution in general. The purpose of this study is to examine the mediating role of technological innovation on the relationship between GSCM practices and social performance in 258 manufacturing firms in Malaysia certified with ISO 14001. Survey data were analysed using partial least squares structural equation modelling (PLS-SEM). The results revealed that GSCM practices had a significant and positive effect on technological innovation and social performance. Moreover, technological innovation had a positive effect on social performance. Technological innovation also mediated between GSCM and social

Manuscript submitted: 9 April 2022, Manuscript revised: 27 June 2022, Accepted for publication: 18 July 2022

performance. Therefore, the present paper confirms the positive effect of GSCM on the technological innovation of manufacturing firms, which in turn improves their social performance. The findings may help manufacturing firms to better understand the significant role of technological innovation in improving their GSCM practices and social performance.

Keywords---green supply chain management, technological innovation, social performance, manufacturing firms.

Introduction

In recent years, local and global environmental issues have become significant concerns of and challenges for business organizations. Increased economic consumption leads to a high level of material and energy utilization by business organisations. 'Business organisations', in this case, refer to manufacturing firms, which are believed to be the most significant contributor to environmental issues (Beamon, 1999). Supply chain management (SCM) has grabbed attention of industrialists globally because of the necessity for strategic planning in the maintenance, design, and operations of supply chain processes. SCM is the most important system used by modern organisations because it is integrated with various operational stages to meet and satisfy market needs and maximise profits (Shafique et al., 2017; Suryanto et al., 2018; Villanueva & García, 2013). While SCM can improve firm performance, some manufacturing firms have overlooked its negative impact on the environment, economy, and society, for example global warming, health diseases, global energy crisis, climate change, and pollution (Suryanto et al., 2018).

These issues motivate the researchers to investigate the effect of GSCM implementation on technological innovation and social performance in Malaysian manufacturing firms. The operations of these firms affect the environment, economy, and society. Environmental issues in Malaysia are becoming more challenging and complex (Shamsuddin et al., 2017; Suryanto et al., 2018; Vaghefi et al., 2015). These issues have resulted from various factors, including the implementation of new technologies for products, development of new types of products, transformations in manufacturing processes, use of cleaner technology, level of housekeeping, capability in managing environmental issues, outdated regulations, and unresolved past environmental issues (Khan & Qianli, 2017; Mohamad et al., 2018; Suryanto et al., 2018). These factors may increase environmental problems, such as water, air, and solid waste pollution.

Green supply chain management (GSCM) has recently emerged to respond and resolve those issues and support environmental protection, economic development, and social development. It is the adoption of green procurement, green manufacturing, and green distribution, thereby creating a green supply chain, to ensure the sustainable performance of the organisation (Çankaya & Sezen, 2019; Khan, 2019; Luthra et al., 2016; Naway & Rahmat, 2019). Wyawahare and Udawatta (2018) defined GSCM as the incorporation of environmental elements into SCM processes, for instance material sourcing and selection, product design, manufacturing practices, final product delivery, and end of life management. GSCM plays an important role to support sustainable development by reducing environmental pollution, waste and costs; creating a stress-free working environment; and optimizing resource utilization (Gandhi et al., 2015). Furthermore, GSCM improves the financial and social performance of an organisation (Patidar, 2018). The ‘green business’ concept emerged in the late 1990s due to growing pressures from communities with an interest in sustainable economic development. In general, a green or sustainable business is one that implements green practices in an attempt to be environmentally friendly and ensures that each product, process, and manufacturing activity sufficiently minimise existing environmental issues while still generating profits (Ahmed et al., 2018).

This study examines the effects of GSCM and green innovation practices on the social performance of manufacturing firms. Though there is much evidence for the positive relationships between GSCM, green innovation, and social performance (Abdullah et al., 2017; Abu Seman et al., 2019; Bhushan et al., 2017; Martínez-Ros & Kunapatarawong, 2019; Sundram et al., 2017; Verma et al., 2018), the effect of GSCM on social performance remains inconclusive (Moori et al., 2018; Xu et al., 2019; Z. Yang et al., 2019). Moreover, most environmental issues in Malaysia are contributed by manufacturing firms. Therefore, there is an urgency to investigate this relationship on a sample of Malaysian manufacturing firms. The present study attempts to examine how manufacturing firms can increase their social performance through GSCM and technological innovation. This paper provides empirical evidence to help manufacturing firms determine their ideal social strategies. In addition, this study examines the direct and indirect effects of GSCM and technological innovation on social performance. It aims to explain the variables that can potentially improve technological innovation and social performance of manufacturing firms. More specifically, it examines the mediating effect of technological innovation on the relationship between GSCM and social performance.

Literature Review

Green Supply Chain Management

Beamon (1999) defined GSC as the extension of the traditional supply chain that includes activities whose main objective is to reduce the environmental impact of a product throughout its entire cycle, such as resource saving, green design, and product recycling and reuse. GSCM are various initiatives and activities undertaken by organisations to cope with institutional pressure and improve overall supply chain and firm performance (Qorri et al., 2018). GSCM has caught the attention of scholars because of its benefit to the environment and organisational performance. Srivastava (2007) stated that GSCM includes green purchasing, green design, green distribution, green production, reverse logistics, and logistics marketing activities. Walker et al. (2008) explained that GSCM practices are implemented in all stages of the product lifecycle, such as production, purchasing, distribution, use, and disposal. GSCM comprises many activates, such as production, design, supply, assembly packaging, logistics, and distribution (Eltayeb & Zailani, 2014; Handfield et al., 1997; Mohamad et al., 2018). Therefore, GSCM is a broad concept. The limitations of GSCM studies are based on the researcher's objectives, as in the case of any supply chain management research (Zhu et al., 2008).

Manufacturing firms have been recognized as one of the largest contributors to environmental pollution. A main reason for this is because many companies are involved in the manufacturing process, from the procurement of raw materials up to delivery of products, which invariably leads to the production of waste materials and other substances that can be harmful to the environment (Hassan, 2016; Ho et al., 2015). The Malaysian government is making efforts to 'green' its manufacturing sector through various initiatives and incentives. The direct and indirect consumption of energy for manufacturing emit carbon dioxide (CO_2), which negatively affects the environment. CO_2 is one of many pollutants created by the manufacturing industry and related to GDP growth (S. Islam et al., 2017; Shafique et al., 2017). The manufacturing sector, therefore, is one of the main contributors to economic, social, and environmental issues.

Those issues motivate the researchers to investigate how GSCM implementation can help Malaysian manufacturing industries to gain competitive advantages and improve their social performance. The manufacturing firms' operations will affect the environment, economy, and society. Environmental issues in Malaysia are becoming more challenging and complex (Shamsuddin et al., 2017; Suryanto et al., 2018; Vaghefi et al., 2015). These issues have resulted from various factors, including the implementation of new technologies for products, development of new types of products, transformations in manufacturing processes, use of cleaner technology, level of housekeeping, capability in managing environmental issues, outdated regulations, and unresolved past environmental issues (Khan & Qianli, 2017; Mohamad et al., 2018; Suryanto et al., 2018). These factors may increase environmental problems, such as water, air, and solid waste pollution.

Recently, Le (2020) explained that the attention of scholars to GSCM practices and social sustainability has been limited compared to economic, financial, environmental, and operational performance. Esfahbodi et al. (2016) found a positive relationship between GSCM and cost and environmental performance, but not social performance. Social performance was measured in terms of increasing health care facilities for the local community. GSCM improves the social performance of firms in the supply chain (Wang & Dai, 2018). It gives a positive image to the firm, which is highly important for both customer and employee satisfaction and loyalty (Hoffman, 2001). Hassan (2016) and Zampese et al. (2016) asserted that GSCM could improve brand image, stakeholder relations, and employee motivation.

Green Supply Chain Management in Malaysia

In Malaysia, discussions on GSCM and technological innovation are still in the preliminary stage. Most firms are still behind in the implementation of both (Abdullah et al., 2016). Eltayeb et al. (2011) stated the level of acceptance and implementation of GSCM is lower in Malaysian- owned firms compared to international and multinational firms. Obstacles to GSCM implementation include the size of the organisation and high cost of adoption (Shamsuddin et al., 2017).

Organisations that implement GSCM are mostly large manufacturing companies (Lee et al., 2010). According to Abdullah et al. (2016), implementing GSCM is expensive because of the accompanying training, learning, technology, and capabilities. Moreover, research on green innovation in Malaysia is still rare. This can be seen from the fact that the implementation of this concept is still in the preliminary stage in Malaysian firms. Firms must overcome certain barriers to implement GSCM and green innovation. Manufacturing firms must have the capability to adopt GSCM and green innovation and realise sustainable economic growth.

The Malaysian government provides two tax incentives to manufacturing firms that implement green practices in their operations: pioneer status (PS) and investment tax allowance (ITA) (Singh, 2017). The purpose of these incentives is to encourage more green investments and operations. The ITA is given for a period of five or ten years to firms that implement green practices and technology in the areas of renewable energy, energy efficiency, green building, green data centre, and waste management (MIDA, 2020). The ITA grants an allowance of 60% on the firm's qualifying capital expenditure, such as factory, plant, machinery, or other equipment used for the approved project incurred within five years from the date the first qualifying capital expenditure is incurred (MIDA, 2021). Therefore, the implementation of GSCM will allow manufacturing firms to enjoy tax allowance.

Malaysia is taking steps to go green in the coming years and improve economic, environmental, and social performance. The Twelfth Malaysia Plan 2021-2025 (12MP), presented to the public in September 2021, encompasses three dimensions, namely environmental sustainability, economic empowerment, and social re-engineering, that are supported by governance and policy tools. Under environmental sustainability, the 12MP covers various issues such as climate change mitigation and adaptation, green technology, and renewable energy. All three dimensions are consistent with the 2030 Sustainable Development Goals (SDGs) Agenda of the United Nations.

In recent years, Malaysia is moving forward to be an industrialised economy and moving from material production to manufacturing. The manufacturing sector is one of the main sources of economic growth and industrialisation. However, it has a negative impact on the environment because it creates waste and pollution and consumes a significant amount of natural resources. The sector or its individual corporations are among the largest contributors of environmental issues, considering that society mostly depends on industrial products to sustain its living standard. These corporations consume resources and emit pollutants throughout the manufacturing process.

While there have been many studies on the adoption of GSCM and green innovation in developing and developed countries, similar studies in the Malaysian context have been minimum (Seman et al., 2018). GSCM adoption differs from a country to another because each has its own obstacles, such as firm size, suppliers, buyers, communities, customers, legislation and regulations, mode of implementation, and internal and external pressures (Eltayeb et al., 2011; Jabbour et al., 2016; Seman et al., 2018). Previous studies show that GSCM practices are very advanced in developed countries such as Germany, Japan, and other European countries (Scur & Barbosa, 2017). However, in developing countries such as Malaysia, GSCM is still considered a new concept in both practice and research (Rao, 2002; Umar et al., 2016).

Technological Innovation

According to the Organisation for Economic Co-operation and Development (OECD) (2018), the novelty characteristic of innovation is based on the use and application of new or modified technology. Oslo (2005) defined the term 'technological' as new or improved products and processes. An organisation can make various types of modifications in its processes, use of factors of production, and type of output to improve productivity and performance. Innovation is also defined as technology or management practice that a firm is implementing for the first time, regardless of whether other organisations or users have previously adopted it. It may also refer to significant restructuring or improvement of a process (Nord & Tucker, 1987). Technological innovation enables organisations to develop innovation capabilities, encourage corporate entrepreneurship, create investment opportunities in scientific and technological endeavours, and ensure the sustainable growth of corporate entrepreneurship in the competitive market (Rojas et al., 2014). In short, technological innovation play an important role in firm and economic growth.

Many scholars argue that product, process, marketing, and organisational innovation can create competitive advantages for the company in terms of price, quality, and delivery (Bhushan et al., 2017; Kafetzopoulos & Psomas, 2015; Wang et al., 2019; Yang & Roh, 2019). The fast-growing economy of Southeast Asian countries such as Malaysia requires shifting the organisational value area from non-technological to technological activities, such as introducing and developing new technologies. Nonetheless, non-technological strategies, such as transforming organisational process, re-establishing business strategies and external network, marketing, and customer interaction, are still needed to support the competitive advantages of manufacturing companies (Seman et al., 2018; Zailani et al., 2015; Zaipul & Ahmad, 2017).

Initial observations showed a link between innovation and competitive advantage, hence embracing Industry 4.0 technologies and processes enables a firm to gain an advantage over global competitors. Innovation enhances competitiveness as the firm can react to market shifts and current trends in technology and innovation (Menon & Shah, 2019). The Malaysian Ministry of International Trade and Industry (MITI) introduced the national Industry 4.0 policy, which is expected to transform the global landscape of manufacturing and make significant improvements to quality and productivity. Embracing Industry 4.0 is a new source of competitive advantage for a firm (MITI, 2018). This policy requires Malaysia to improve its technological level in the manufacturing industry so as to enhance innovation and competitiveness.

While technological innovation has become an important topic in developing countries such as Malaysia, studies on the subject have been minimum. In contrast, there is significant research on green innovation in developed countries such as the United States and Sweden (Calza et al., 2017; Rozar et al., 2015;

Seman et al., 2018; Tan, Zailani, Tan, & Shaharudin, 2016). Furthermore, there are limited studies that discuss technological innovation as a mediator between GSCM practices and social performance (Moori et al., 2018; Xu et al., 2019; Z. Yang et al., 2019). Thus, this study examines how GSCM practices (internal environmental management, green purchasing, eco-design and packaging, investment recovery, and cooperation with customers) influence technological innovation and social performance, and how technological innovation mediates between GSCM practices and social performance. Past studies have failed to highlight the multidimensionality of technological innovation and only examined the concept of technology innovation in general (Camisón & López, 2010; Camisón & Villar-López, 2014; Lee et al., 2018; Nuryakin, 2018; Raymond et al., 2013).

Social Performance

Social performance is the “firm’s ability to be socially responsible for the community stakeholder relationship through CSR programmes, improve the social quality of employees, and equality without discrimination” (Fernando & Saththasivam, 2017). Bowen (1953) provided the first definition for the concept: strategies, decisions, and actions of the organisation to create value for society. Carroll (1979) further defined social performance as an organisation’s consideration of stakeholder expectations on social, ethical, legal, and economic aspects. Wartick and Cochran (1985) categorised corporate social responsibility (CSR) into three dimensions of economic responsibility, public responsibility, and social responsiveness. More firms are incorporating sustainability elements into their business practices and manufacturing operations, for instance waste management, resource efficiency, and CSR programs, to improve social performance and gain competitive advantages (Le, 2020). Manufacturing companies are required to carry out their social responsibilities, and corporate social performance is gaining importance in strategic management (Distelhorst et al., 2017). The assumption of social responsibilities by firms is driven by growing pressures from stakeholders, government, and customers to consider the social impact of their activities (Davis et al., 2020). Therefore, social sustainability has become a significant factor in maintaining corporate sustainability.

The impact of corporate social performance is not only restricted to society, the environment, and stakeholders, but it also has positive effects on the organisation. For example, the firm has higher ability to attract talented employees (Greening & Turban, 1996), more financial access (Cheng et al., 2014), improved risk management (Koh et al., 2014), and more recommendations from stock analysts (Luo et al., 2015). Global market transformations calling for social and community responsibilities of firms have required them to consider social and environmental concerns in their business’ activities (Çankaya & Sezen, 2019). Social performance, in particular, appears to enable firms to join and compete in the global market.

The waste from manufacturing companies fills landfills and affects society. The World Health Organization (2018) in its Global Burden of Disease (GBD) report stated that ambient air pollution is one of the highest risk factors for disability and death. Household air pollution ranked eighth in the risk factor for early death, accounting for 2.6 million deaths around the globe. It comes from the use of solid fuels (e.g., coal, wood, and dung) for heating and cooking. Ambient particulate matter (particulate matter less than or equal to 2.5 micrometres in aerodynamic diameter, or PM2.5) is the sixth highest risk factor for early death, accounting for 4.1 million deaths globally. Air pollution is responsible for many diseases, such as chronic lung disease, heart disease, stroke, and lung cancer (Peden et al., 2016).

CSR in Malaysia is still developing. Manufacturing firms are still facing difficulty in CSR practices because they are unable to effectively minimise waste, which negatively affect society and their health. For example, a recent case of intentional pollution occurred in Pasir Gudang, Johor Bahru in March 2019, causing students and teachers in nearby schools to suffer from dizziness, breathing difficulties, nausea, and vomiting. More than 100 schools were ordered to close as well. The chemical waste was intentionally dumped in the Kim Kim River in the early morning before the victims fell ill. The toxic pollutants were unable to be removed easily, and rain and wind spread them to other places (Yap et al., 2019). Based on the above discussion, the following hypotheses were proposed (see Figure 1):

- GSCM practices have a positive effect on technological innovation.
- GSCM practices have a positive effect on social performance.
- Technological innovation has a positive effect on social performance.
- Technological innovation mediates the relationship between GSCM practices and social performance.

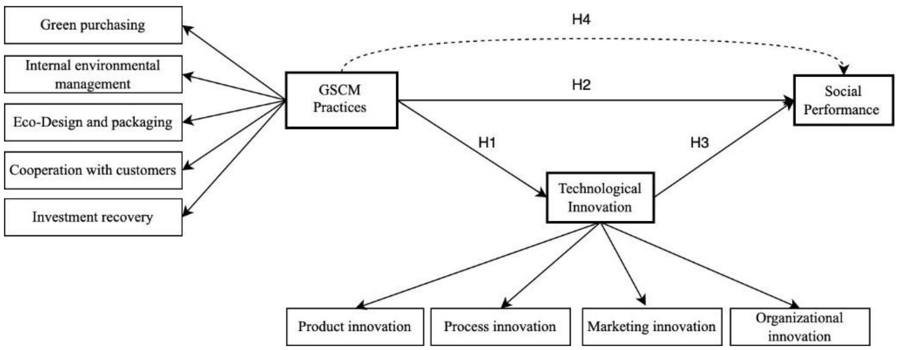

Figure 1. Research Framework

Methodology

The quantitative methodology was employed to investigate the mediating effect of technological innovation on the relationship between GSCM practices and social performance in Malaysian manufacturing firms. Because of the Covid-19 pandemic, the questionnaires were distributed online to firms listed in the directories of the Federation of Malaysian Manufacturers (FMM) and Standard and Industrial Research Institute of Malaysia (SIRIM), which contain over 2,500 manufacturing and services firms of different sizes. Both directories are a valid representation of the research population. The research hypotheses were tested using partial least squares structural equation modelling (PLS-SEM) run with the SmartPLS software (Ramayah et al., 2018).

The items were measured on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). GSCM practices comprised five dimensions and were measured using 25 items (Çankaya & Sezen, 2019; Eltayeb & Zailani, 2014; Le, 2020; Tan et al., 2018; Zhu & Sarkis, 2004). Technological innovation comprised four dimensions and 22 items (Camisón & Villar-López, 2014; Kafetzopoulos & Psomas, 2015; Lee et al., 2018). Social performance was measured using seven items (Çankaya & Sezen, 2019; Cheah et al., 2019). The research data were collected from 258 manufacturing firms certified with ISO14001 in a period of approximately four months in 2021.

Results

Measurement Model Assessment

As recommended by Hair Jr et al. (2017), this study first measured the reliability and validity of the measurement model using Cronbach's alpha and composite reliability (CR). Cronbach's alpha evaluates the internal consistency of a construct. According to Hair Jr et al. (2017), the acceptable value of Cronbach's alpha and CR is > 0.7. Table 1 shows that the Cronbach's alphas and CR values of all constructs were > 0.70, indicating adequate internal reliability. Similarly, the factor loadings of most items were above the acceptable threshold of 0.7 (Hair Jr et al., 2017), except IEM5, GP1, PTI4, and PSI3, which were subsequently deleted. Average variance extracted (AVE) is a standard measure of convergent validity, and an AVE of > 0.50 is considered acceptable (Hair et al., 2010). The AVE values in this study ranged from 0.653 to 0.740. Satisfactory convergent validity was therefore established. To determine discriminant validity, the heterotrait-monotrait ratio (HTMT) was computed (Hair et al., 2017).

Table 1
Item loadings, Cronbach's alpha, CR and AVE

Constructs	Indicators	Loading (> 0.7)	Cronbach's Alpha	Composite Reliability	AVE
	GP1	Deleted			
	GP2	0.893 0.902			
Green	GP3	0.772			
purchasing	GP4	0.753			
(GP)	GP5		0.901	0.927	0.718
	GP6	0.902			
	IEM1	0.864			
Internal	IEM2	0.860 0.835			
environmental	IEM3	0.845			
management	IEM4	Deleted			
(IEM)	IEM5		0.906	0.930	0.725
	IEM6	0.855			
	EP1	0.836			
	EP2	0.840 0.777			
Eco-Design and	EP3	0.843			
Packaging (EP)	EP4		0.892	0.921	0.699

	EP5	0.882			
	IR1	0.812 0.898			
Investment recovery (IR)	IR2	0.900			
	IR3		0.884	0.919	0.740
	IR4	0.828			
	CC1	0.830 0.876			
Customer cooperation (CC)	CC2	0.857			
	CC3	0.863			
	CC4		0.910	0.933	0.735
	CC5	0.851			
	PTI1	0.820			
	PTI2	0.825			
Product innovation (PTI)	PTI3	0.832			
	PTI4	Deleted			
	PTI5	0.827	0.811	0.913	0.677
	PTI6	0.788			
	PSI1	0.842			
	PSI2	0.797			
Process innovation (PSI)	PSI3	Deleted			
	PSI4	0.857			
	PSI5	0.881	0.899	0.925	0.712
	PSI6	0.839			
	MI1	0.824	0.868	0.904	0.653
	MI2	0.836 0.805			
Marketing innovation (MI)	MI3	0.776			
	MI4	0.797			
	MI5				
	OI1	0.850			
	OI2	0.841 0.840			
Organizational innovation (OI)	OI3	0.834			
	OI4		0.896	0.923	0.705
	OI5	0.834			
	SP1	0.846 0.780			
	SP2	0.814 0.805			
	SP3	0.870			
Social performance (SP)	SP4				
	SP5		0.919	0.935	0.671
	SP6	0.830			
	SP7	0.787			

Key: IME: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PTI: product innovation, PSI: process innovation, MI: marketing innovation, OI: organization innovation, SP: social performance.

Henseler et al. (2014) suggested that an acceptable HTMT value is < 0.90. Table 2 shows that all HTMT values were lower than the recommended threshold. Goodness of fit (GOF) was measured using the standardised root mean square residual (SRMR). SRMR evaluates the overall fit of the model so as to assess its predictive capabilities (Henseler et al., 2014). The SRMR was 0.07, which is within the acceptable range, indicating good model fit (Henseler et al., 2016).

Table 2
Assessment of Discriminant Validity using HTMT

	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**

Structural Model Assessment

After confirming the validity and reliability of the measurement model, the structural model was evaluated and the hypotheses were tested (Hair Jr et al., 2017). In PLS-SEM, path coefficients and R^2 are used to assess the structural model. Figure 1 and Table 4 show the final structural model and the R^2 of the constructs. R^2 is the amount of variance in the endogenous variable (dependent variable) is explained by the exogenous variables (independent variables). The R^2 of the main target constructs should be high. The minimum acceptable R^2 proposed by Falk and Miller (1992) is 0.19. Meanwhile, Chin (1998) suggested that R^2 values of 0.67, 0.33, and 0.19 can be considered as strong, moderate, and weak, respectively.

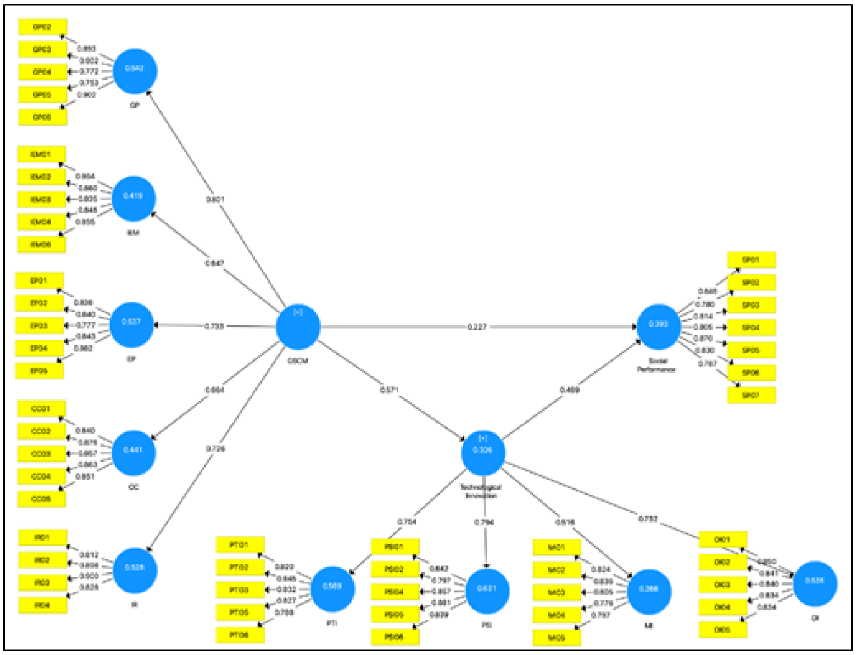

Figure 1. Path coefficient results

The R^2 of technological innovation was 0.326, which means that 36% of the variance in technological innovation can be explained by product, process, marketing, and organisational innovation (see Table 3). The R^2 of social performance was 0.393, indicating that GSCM accounted for approximately 39% of its total variance.

Table 3
R^2 of Endogenous Latent Variables

Construct	R^2		
		Cohen (1988)	Chin (1998)
Technological Innovation	0.326	Strong	Moderate
Social Performance	0.393	Strong	Moderate

The bootstrap method was used to evaluate the structural model (Chin, 2010). Table 4 shows the results of the hypotheses testing. GSCM had a strong direct relationship with both technological innovation (β = 0.571, t = 8.608, $p < 0.01$) and social performance (β = 0.227, t = 3.492, $p < 0.01$). Therefore, H1 and H2 were supported. Additionally, the direct relationship between technological innovation and social performance was significant and strong (β = 0.469, t = 6.434, $p < 0.01$). Thus, H3 was accepted.

Table 4
Structural model: direct effects

	Relationship	Std Beta	Mean (M)	Std Error	*t*-value	*p*-value	Decision
H1	GSCM→TI	0.571	0564	0.066	8.608	0.000	Supported
H2	GSCM→SP	0.227	0.228	0.065	3.492	0.000	Supported
H3	TI→SP	0.469	0.467	0.073	6.434	0.000	Supported

Key: GSCM: green supply chain management, TI: technological innovation, SP: social performance.

The mediating effect was analysed next. As shown in Table 5, technological innovation had a partial mediating effect on the relationship between GSCM practices and social performance (β = 0.253, t = 5.206, p < 0.01). Thus, H4 was supported.

Table 5
Structural model: Mediation analysis

Relationship	**Indirect Effect**			**Confidence interval**		**Decision**
	Path coeff.	Std Error	*t* -value	95% LL	95% UL	
H4 GSCM→TI→SP	0.253	0.060	4.219**	0.136	0.371	Mediation

Note: ** = P < 0.001, LL: Lower level, UL: Upper level.

Conclusion

This study has reviewed the literature and presented empirical evidence on the interrelationships between GSCM practices, technological innovation, and social performance. The findings can support managers of manufacturing firms to implement GSCM practices to improve performance. This study has contributed to the empirical literature on sustainability management, more specifically GSCM, and the social performance of manufacturing firms. It presents a useful model to examine the direct effects of GSCM practices and technological innovation on social performance, as well as the mediating effect of technological innovation on the relationship between GSCM practices and social performance. The theoretical contribution of this study is twofold. First, it presents empirical evidence on the role of technological innovation as a mediator between GSCM practices and social performance. Second, it presents empirical evidence on the link between GSCM practices, technological innovation, and social performance in Malaysian manufacturing firms.

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

Abdullah, M., Zailani, S., Iranmanesh, M., & Jayaraman, K. (2016). Barriers to green innovation initiatives among manufacturers: the Malaysian case. *Review of Managerial Science*, *10*(4), 683–709. https://doi.org/10.1007/s11846-015-0173-9

Abdullah, R., Mohamad, M. N., & Thurasamy, R. (2017). Supply chain integration: Level of existence in green supply chain management practices among Malaysian ISO 14001 manufacturing firms. *International Journal of Supply Chain Management*, *6*(2), 243–249.

Abu Seman, N. A., Govindan, K., Mardani, A., Zakuan, N., Mat Saman, M. Z., Hooker, R. E., & Ozkul, S. (2019). The mediating effect of green innovation on the relationship between green supply chain management and environmental performance. *Journal of Cleaner Production*, *229*(March), 115–127. *https://doi.org/10.1016/j.jclepro.2019.03.211*

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., 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., 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.

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.

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

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., 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., 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., 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.

Ahmed, S., Akter, T., & Ma, Y. (2018). Green Supply Chain Management (GSCM) Performance Implemented by the Textile Industry of Gazipur District, Dhaka. *Logistics*, *2*(4), 21. https://doi.org/10.3390/logistics2040021

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

Bhushan, A., Zanwar, A., Jain, N., & Rao, P. H. (2017a). Technological Integration and Sustainable Initiatives to bring in Efficiency in Supply Chain in Indian Multi-Brand Retail.
Journal of Supply Chain Management Systems, *6*(1), 51–60.

Bhushan, A., Zanwar, A., Jain, N., & Rao, P. H. (2017b). Technological Integration and Sustainable Initiatives to bring in Efficiency in Supply Chain in Indian Multi-Brand Retail.
Journal of Supply Chain Management Systems, *6*(1), 51–60. http://esc-web.lib.cbs.dk/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN =122819671&site=ehost-live&scope=site

Bowen, H. (1953). Social Responsibilities of the Businessman Harper & Row. In *New York*.

Calza, F., Parmentola, A., & Tutore, I. (2017). Types of green innovations: Ways of implementation in a non-green industry. *Sustainability (Switzerland)*, *9*(8). https://doi.org/10.3390/su9081301

Camisón, C., & López, A. V. (2010). An examination of the relationship between manufacturing flexibility and firm performance: The mediating role of innovation. *International Journal of Operations and Production Management*, *30*(8), 853–878. https://doi.org/10.1108/01443571011068199

Camisón, C., & Villar-López, A. (2014a). Organizational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of Business Research*, *67*(1), 2891– 2902. https://doi.org/10.1016/j.jbusres.2012.06.004

Camisón, C., & Villar-López, A. (2014b). Organizational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of Business Research*, *67*(1), 2891– 2902. https://doi.org/10.1016/j.jbusres.2012.06.004

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

Carroll, A. B. (1979). A Three-Dimensional Conceptual Model of Corporate Performance.
Academy of Management Review, *4*(4), 497–505. https://doi.org/10.5465/amr.1979.4498296

Cheah, J., Amran, A., & Yahya, S. (2019). Internal oriented resources and social enterprises' performance: How can social enterprises help themselves before helping others? *Journal of Cleaner Production*, *211*, 607–619. https://doi.org/10.1016/j.jclepro.2018.11.203

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*. https://doi.org/10.1002/smj.2131

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

Chin, W. W. (2010). How to write up and report PLS analyses. Handbook of Partial Least Squares. In *Handbook of Partial Least Squares*.

Davis-Sramek, B., Robinson, J. L., Darby, J. L., & Thomas, R. W. (2020). Exploring the differential roles of environmental and social sustainability in carrier selection decisions.
International Journal of Production Economics, *227*. https://doi.org/10.1016/j.ijpe.2020.107660

Distelhorst, G., Hainmueller, J., & Locke, R. M. (2017). Does lean improve labor standards? Management and social performance in the nike supply chain. *Management Science*, *63*(3), 707–728. https://doi.org/10.1287/mnsc.2015.2369

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

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes.
Resources, Conservation and Recycling, *55*(5), 495–506. https://doi.org/10.1016/j.resconrec.2010.09.003

Esfahbodi, A., Zhang, Y., & Watson, G. (2016). Sustainable supply chain management in emerging economies: Trade-offs between environmental and cost performance. *International Journal of Production Economics*, *181*, 350–366.

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

Fernando, Y., & Saththasivam, G. (2017). Green supply chain agility in EMS ISO 14001 manufacturing firms: Empirical justification of social and environmental performance as an organisational outcome. *International Journal of Procurement Management*, *10*(1), 51–69. https://doi.org/10.1504/IJPM.2017.080911

Gandhi, S., Mangla, S. K., Kumar, P., & Kumar, D. (2015). Evaluating factors in implementation of successful green supply chain management using DEMATEL: A case study. In *International Strategic Management Review* (Vol. 3, Issues 1–2). Holy Spirit University of Kaslik. https://doi.org/10.1016/j.ism.2015.05.001

Greening, D. W., & Turban, D. B. (1996). Corporate Social Performance and Organizational

Attractiveness to Prospective Employees. *Proceedings of the International Association for Business and Society*, *7*, 489–500. https://doi.org/10.5840/iabsproc1996746

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.*

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.

Handfield, R. B., Walton, S. V, Seegers, L. K., & Melnyk, S. A. (1997). "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

Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., Ketchen, D. J., Hair, J. F., Hult, G. T. M., & Calantone, R. J. (2014). Common Beliefs and Reality About PLS: Comments on Rönkkö and Evermann (2013). *Organizational Research Methods*, *17*(2). https://doi.org/10.1177/1094428114526928

Ho, T. C., Keat, S. C., Jafri, M. Z. M., & San, L. H. (2015). A prediction model for CO2 emission from manufacturing industry and construction in Malaysia. *International Conference on Space Science and Communication, IconSpace*, *2015-Septe*(August), 469–472. https://doi.org/10.1109/IconSpace.2015.7283771

Hoffman, A. J. (2001). Linking organizational and field-level analyses: The diffusion of corporate environmental practice. *Organization & Environment*, *14*(2), 133–156.

Islam, S., Karia, N., Fauzi, F. B. A., & Soliman, M. S. M. (2017). A review on green supply chain aspects and practices. In *Management and Marketing* (Vol. 12, Issue 1, pp. 12–36). https://doi.org/10.1515/mmcks-2017-0002

Jabbour, C. J. C., De Sousa Jabbour, A. B. L., Govindan, K., De Freitas, T. P., Soubihia, D. F., Kannan, D., & Latan, H. (2016). Barriers to the adoption of green operational practices at Brazilian companies: Effects on green and operational performance. *International Journal of*

Production Research, *54*(10), 3042–3058. https://doi.org/10.1080/00207543.2016.1154997 Kafetzopoulos, D., & Psomas, E. (2015a). The impact of innovation capability on the performance of manufacturing companies the Greek case. In *Journal of Manufacturing Technology Management* (Vol. 26, Issue 1). https://doi.org/10.1108/JMTM-12-2012-0117

Kafetzopoulos, D., & Psomas, E. (2015b). The impact of innovation capability on the performance of manufacturing companies the Greek case. In *Journal of Manufacturing Technology Management* (Vol. 26, Issue 1). https://doi.org/10.1108/JMTM-12-2012-0117

Khan, S. A. R. (2019). *The Effect of Green logistics on Economic growth, Social and Environmental sustainability: An Empirical study of Developing countries in Asia. January*. https://doi.org/10.20944/preprints201901.0104.v1

Khan, S. A. R., & Qianli, D. (2017). Impact of green supply chain management practices on firms' performance: an empirical study from the perspective of Pakistan. *Environmental Science and Pollution Research*, *24*(20), 16829–16844. https://doi.org/10.1007/s11356-017-9172-5

Koh, P. S., Qian, C., & Wang, H. (2014). Firm litigation risk and the insurance value of corporate social performance. *Strategic Management Journal*. https://doi.org/10.1002/smj.2171

Le, T. T. (2020a). The effect of green supply chain management practices on sustainability performance in Vietnamese construction materials manufacturing enterprises. *Uncertain Supply Chain Management*, *8*(1), 43–54. https://doi.org/10.5267/j.uscm.2019.8.007

Le, T. T. (2020b). The effect of green supply chain management practices on sustainability performance in Vietnamese construction materials manufacturing enterprises. *Uncertain Supply Chain Management*, *8*(1), 43–54. https://doi.org/10.5267/j.uscm.2019.8.007

Lee, J., Cerreto, F. A., & Lee, J. (2010). Theory of planned behavior and teachers' decisions regarding use of educational technology. *Educational Technology and Society*, *13*(1), 152– 164.

Lee, V. H., Ooi, K. B., Chong, A. Y. L., & Sohal, A. (2018a). The effects of supply chain management on technological innovation: The mediating role of guanxi. *International Journal of Production Economics*, *205*, 15–29. https://doi.org/10.1016/j.ijpe.2018.08.025

Lee, V. H., Ooi, K. B., Chong, A. Y. L., & Sohal, A. (2018b). The effects of supply chain management on technological innovation: The mediating role of guanxi. *International Journal of Production Economics*, *205*, 15–29. https://doi.org/10.1016/j.ijpe.2018.08.025

Luo, X., Wang, H., Raithel, S., & Zheng, Q. (2015). Corporate social performance, analyst stock recommendations, and firm future returns. In *Strategic Management Journal*. https://doi.org/10.1002/smj.2219

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

Martínez-Ros, E., & Kunapatarawong, R. (2019). Green innovation and knowledge: The role of size. *Business Strategy and the Environment*, *28*(6), 1045–1059. https://doi.org/10.1002/bse.2300

Menon, S., & Shah, S. (2019). An Overview of Digitalisation in Conventional Supply Chain

Management. *MATEC Web of Conferences*, *292*, 01013. https://doi.org/10.1051/matecconf/201929201013 MIDA. (2020). *Incentives for New Investments*.

MIDA. (2021). *Green Technology Incentives: Towards Achieving Sustainable Development in Malaysia - MIDA | Malaysian Investment Development Authority*. Mida.Gov.My. https://www.mida.gov.my/green-technology-incentives-towards-achieving-sustainabledevelopment-in-malaysia/

MITI. (2018). *National Policy on Industry 4.0, Ministry of International Trade and Industry*. Ministry of International Trade and Industry.

Mohamad, M. N., Samuel, C., & Koilpillai, S. (2018a). *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

Mohamad, M. N., Samuel, C., & Koilpillai, S. (2018b). *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

Naway, F. A., & Rahmat, A. (2019). The mediating role of technology and logistic integration in the relationship between supply chain capability and supply chain operational performance.

Uncertain Supply Chain Management, *7*(3), 553–566. https://doi.org/10.5267/j.uscm.2018.11.001

Nord, W. R., & Tucker, S. (1987). *Implementing routine and radical innovations*. Free Press.

Nuryakin. (2018). Competitive advantage and product innovation: Key success of Batik SMEs marketing performance in Indonesia. *Academy of Strategic Management Journal*, *17*(2), 1– 17.

OECD. (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities. In *Handbook of Innovation Indicators and Measurement*. https://doi.org/10.1787/9789264304604-en

OSLO. (2005). The Measurement Of Scientific And Technological Activities. *Oslo Manual. Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*.

Patidar, S. (2018). *Prioritization and Analysis of Different Factors of GSCM : A Small Scale Cotton Industry in India*. *7*(4), 1–8.

Peden, M., Toroyan, T., Krug, E., & Iaych, K. (2016). The status of global road safety: The agenda for sustainable development encourages urgent action. *Journal of the Australasian College of Road Safety*, *27*(2), 37.

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. (2002). Greening the supply chain: A new initiative in South East Asia. *International*

Journal of Operations and Production Management, *22*(5–6), 632–655. https://doi.org/10.1108/01443570210427668

Raymond, L., Bergeron, F., & Croteau, A. M. (2013). Innovation Capability and Performance Of Manufacturing Smes: The Paradoxical Effect of IT Integration. *Journal of Organizational*

Computing and Electronic Commerce, *23*(3), 249–272. https://doi.org/10.1080/10919392.2013.807714

Rojas, R. M., Álvarez, N. G., Morales, V. J. G., & Moreno, A. G. (2014). The use of technology to improve organizational performance through corporate entrepreneurship. *International Journal of Management Science & Technology Information*, *0265*(14), 49–74.

Rozar, N., Ibrahim, A., & Razik, M. A. (2015). Using Quality Function Deployment (QFD) In Designing The " Green Practice " Of Gscm For Malaysia's Smes Industries. *International Journal of Application or Innovation in Engineering and Management*, *4*(10), 30–37.

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

Shamsuddin, A., Wahab, E., Abdullah, N. H., & Qazi, F. H. (2017a). Green supply chain implementation in manufacturing industry: A case study. *International Journal of GEOMATE*, *13*(38), 31–37. https://doi.org/10.21660/2017.38.78453

Shamsuddin, A., Wahab, E., Abdullah, N. H., & Qazi, F. H. (2017b). Green supply chain implementation in manufacturing industry: A case study. *International Journal of GEOMATE*, *13*(38), 31–37. https://doi.org/10.21660/2017.38.78453

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.14682370.2007.00202.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. (2018a). *The Correlates of Developing Green Supply Chain Management Practices : Firms Level Analysis in Malaysia. October*.

Suryanto, T., Haseeb, M., & Hartani, N. H. (2018b). *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., Yeo, S. F., & Low, C. H. (2018). Green supply chain management practices and organizational performance: An empirical study in Malaysian manufacturing firms. *Jurnal Pengurusan*, *52*, 19–32.

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

Umar, M. S., Danjuma, I., Hammawa, D. D., & Habibu, S. A. (2016). Effects of technological innovation in relationship between green supply chain management practices and green performance. *International Review of Management and Marketing*, *6*(4), 677–682.

Vaghefi, N., Siwar, C., & Aziz, S. (2015). Green GDP and Sustainable Development in Malaysia.
Current World Environment, *10*(1), 01–08. https://doi.org/10.12944/cwe.10.1.01

Verma, D., Dixit, R. V, & Singh, K. (2018). Green Supply Chain Management: a necessity for sustainable development. *The IUP Journal of Supply Chain Management*, *15*(1), 40–58.

Villanueva, R., & García, J. L. (2013). *Green Supply Chain Management; a competitive advantage. October*.

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, J., & Dai, J. (2018). Sustainable supply chain management practices and performance.
Industrial Management and Data Systems, *118*(1), 2–21. https://doi.org/10.1108/IMDS-122016-0540

Wang, Y., Su, X., Wang, H., & Zou, R. (2019). Intellectual capital and technological dynamic capability: evidence from Chinese enterprises. *Journal of Intellectual Capital*, *20*(4), 453– 471. https://doi.org/10.1108/JIC-06-2018-0096

Wartick, S. L., & Cochran, P. L. (1985). The evolution of the corporate social performance model. *Academy of Management Review*, *10*(4), 758–769.

WHO, W. H. O. (2018). Ambient and household air pollution and health. *Who*, *May 2018*, 1–6.

Wyawahare, A., & Udawatta, N. (2018). *A Framework for Successful Implementation of Green Supply Chain Management (GSCM) in Construction Organisations*. *1*, 402–392. https://doi.org/10.29007/jx4z

Xu, J., Shang, Y., Yu, W., & Liu, F. (2019). Intellectual capital, technological innovation and firm performance: Evidence from China's manufacturing sector. *Sustainability (Switzerland)*, *11*(19), 1–15. https://doi.org/10.3390/su11195328

Yang, J. Y., & Roh, T. (2019). Open for green innovation: From the perspective of green process and green consumer innovation. *Sustainability (Switzerland)*, *11*(12), 1–18. https://doi.org/10.3390/su10023234

Yang, Z., Li, X., Sun, J., & Zhang, Y. (2019). Informal alignment in digital innovation for corporate sustainability. *25th Americas Conference on Information Systems, AMCIS 2019*, *Molla 2013*, 1–10.

Yap, C. K., Peng, S. H. T., & Leow, C. S. (2019). Contamination in Pasir Gudang Area, Peninsular Malaysia: What can we learn from Kim Kim River chemical waste contamination? *Journal of Humanities and Education Development*, *1*(2), 82–87. https://doi.org/10.22161/jhed.1.2.4

Zailani, S., Govindan, K., Iranmanesh, M., Shaharudin, M. R., & Sia Chong, Y. (2015). Green innovation adoption in automotive supply chain: the Malaysian case. *Journal of Cleaner Production*, *108*, 1115–1122. https://doi.org/10.1016/j.jclepro.2015.06.039

Zaipul, A. Z., & Ahmad, R. S. (2017). Policies, Challenges and Strategies for Municipal Waste Management in Malaysia. *Journal of Science, Technology and Innovation Policy*, *3*(1), 18– 22.

Zampese, E. R. de S., Moori, R. G., & Caldeira, A. (2016). Green Marketing As a Mediator Between Supply Chain Management and Organizational Performance. *RAM. Revista de Administração Mackenzie*, *17*(3), 183–211. https://doi.org/10.1590/167869712016/administracao.v17n3p183-211

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, *22*(3), 265–289. https://doi.org/10.1016/j.jom.2004.01.005

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

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

Exposto, L. A. S., & Januraga, P. P. (2021). Domestic waste characteristics and the management systematic review. International Journal of Health & Medical Sciences, 4(2), 253-259. https://doi.org/10.31295/ijhms.v4n2.1731