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Green Supply Chain Management orientation and firm performance: evidence from South Korea

Jin Hwan Kim* and Sunhee Youn

College of Business Administration,
Hongik University, 72-1 Sang-su Dong,
Mapo-Gu, Seoul, 121-791, South Korea
E-mail: gjhkim@mail.hongik.ac.kr
E-mail: gsunhee@hanmail.net
*Corresponding author

James Jungbae Roh

Management & Entrepreneurship,
William G. Rohrer College of Business,
Rowan University, 201 Mullica Hill Road,
Glassboro, NJ 08028, USA
E-mail: roh@rowan.edu

Abstract: With environmental regulations taking effect worldwide, Green Supply Chain Management (GSCM) has risen to prominence due to its emphasis on tackling complex environmental processes while improving the bottom line performance. Since GSCM involves transferring green knowledge and standardising production and delivery processes, the success of joint efforts among supply chain partners hinges on how tightly the trust relationship with partners is woven. This study, based on 125 companies from South Korea, shows that GSCM orientation positively influences firm performance via supply chain partners' trust and information sharing. This research suggests the significance of solid trust relationship among supply chain partners in the course of implementing and pursuing GSCM.

Keywords: green supply chain; partners' trust; information sharing.

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Biographical notes: Jin Hwan Kim received his MBA and PhD in Management Accounting from Hongik University. He has been involved in a range of management control system related research projects in Korean firms. His papers have been published in journals including *Korean Management Review, Korean Accounting Review, Korean Accounting Journal, Accounting Information Review*, and *The Korean Small Business Review*. His research interests are in balanced scorecards, strategic performance measurement systems, operational strategy and supply chain management. He currently lectures in these subjects at Hongik University.

Sunhee Youn is a Researcher at the Institute of Management and a Lecturer at the Hongik University, Korea. She received her MBA and PhD from Hongik University in Seoul, Korea. Her papers have been published in journals

including *Int. J. Logistics Systems and Management, The Korean Production Management Review, Korean Association of Business Education Review, Journal of Business Research, Journal of Korean Society for Quality Management.* Her research interests are in supply chain management, green supply chain management and operational strategy.

James Jungbae Roh is an Assistant Professor of Management & Entrepreneurship at the William G. Rohrer College of Business at Rowan University, USA. He holds a Doctoral Degree in Manufacturing Management and Engineering, and a MBA and MA from the University of Toledo, and BA from Dongguk University, Seoul, Korea. His research interests are in the interface between supply chain strategy, sustainability, and technology management. His papers have appeared in *Information and Management, International Journal of Production Economics, Journal of Enterprise Information Management, and Research in International Business and Finance.*

1 Introduction

Several reasons explain why GSCM has recently drawn much interest from managers and researchers. Environmental regulations have taken effects worldwide and stronger directives are being given consideration for implementation. Global warming seem to be in effect in global scale and, as a result, more consumers are concerned about business ethics. Furthermore, firms began to view GSCM as an strategic choice to streamline manufacturing and distribution processes to increase the bottom line. GSCM focuses on embedding efficiency into the supply chain through waste reduction and product and service innovation, which necessitates joint supply chain efforts with suppliers, distributors and customers. Since GSCM involves transferring green knowledge and standardising production and delivery processes, the success of such joint efforts among supply chain partners highly hinges on how tightly trust relationship is woven and how securely product and risk information is shared among the partners. Although prior research on sustainability has delved into the issues in product design, producer's responsibility and environmental policy, few studies have investigated the role of trust and information sharing in aligning GSCM orientation in a supply chain. This study aims at investigating two research questions:

- Does the implementation of GSCM positively affect firm performance?
- Do trust and information sharing play a positive role in enhancing firm performance?

The first research question purposes to ascertain whether or not GSCM is associated with firm performance. The positive influence of green management has been reported mainly in Europe and North America (van Hock, 1999; Rao and Holt, 2005; Vachon and Klassen, 2006; Markley and Davis, 2007), but there are few studies that show its impact in Asia. The second research question touches the information sharing practices in GSCM. Although prior research recognised information sharing as an underpinning enabler of supply chain management (Panteli and Sockalingam, 2005; Li and Lin, 2006; Cheng et al., 2008; Markley and Davis, 2007; Hansmann and Cludia, 2001; Madu, 1996), most research dealt with general information sharing. Few studies have differentiated risk

information sharing from general information sharing and investigated their differing roles.

This research makes three important contributions. First, this study provides a framework for understanding how green management increases firm performance from the trust and information sharing perspective. This paper defines green management orientation in a supply chain context and examines its impact on firm performance that is mediated by trust and information sharing. Second, this study takes a deeper look at information sharing. General information sharing has drawn much attention in various contexts from product design to organisational behaviour. In addition to general information sharing, this study sheds light on the significance of risk information sharing and its impact on performance. Third, this research pays close attention to firm performance. Firm performance was classified into three sub-constructs: customer performance, operational effectiveness, and financial performance. These differentiated performance measures help to grasp the impact of green management orientation in more details. We believe that the empirical study from 125 companies from South Korea also shows a glimpse of green management penetration in Asia.

The remainder of this paper is structured as follows. Section 2 develops a theoretical model and hypotheses. Section 3 presents research methodology regarding the data collection process and analysis method used in this study. Section 4 explains the outcomes of hypotheses tests, and the final section discusses conclusions, the implications, and future research directions.

2 Theory development

2.1 Theoretical background

2.1.1 GSCM orientation

Environmental issues have had great impacts on industrial management systems and styles. Since the late 1920s, a managerial paradigm, 'green management', has helped to guide companies to cope with environmental issues. GSCM is defined as a set of practices intended to effect, control and support environmental performance by allocating possible human material resources and redefining organisational responsibilities and procedures. GSCM allows companies to minimise wastes and pollution production and at the same time helps them to develop an overall ethos of environmental sustainability.

A number of factors have increased pressures for firms to respond to environmental issues. Such factors include agreements made by international environmental conventions, fortified environment-related laws, and consumer-oriented social values that emphasise the preservation of nature. Consequently, GSCM has received much attention from both researchers and practitioners.

GSCM orientation has been defined in various ways. Godfrey (1998) defines it as a tool to improve the environmental performances of supply chains. Narasimhan and Carter (1998) term it as cooperation among purchasing departments to enhance the environmental friendliness of supply chains through solutions such as recycling and the use of alternative, non-hazardous materials. Qinghua and Joseph (2004) view an environment-friendly industrial structure as a set of industries and production systems that minimise the use of resources and maximise recyclable resources. The World Summit on Sustainable Development puts much emphasis on the implementation of

eco-efficiency, accumulating 'Clear Production' as an axis of successful sustainable development. Drawing from these previous researches, this study defines GSCM orientation as a set of business philosophy and practices intended to control and support improvement of environmental results in a supply chain.

2.1.2 GSCM orientation in South Korea

South Korea, one of the top 13 countries in terms of economic scale, has increased its Gross Domestic Product (GDP) largely from its export to the world (61.3% of GDP in 2007). It was probably Phenol leakage accident in 1991 that evoked people's awareness to the harms of firms' environmental mismanagement and their social responsibilities. In the past, however, the Korean government and firms had not given serious thought to environmental issues because green agendas were deemed secondary to economic growth. With environmental directives such as RoHS, ELV, WEEE, REACH, and EUP taking effect worldwide (Rao, 2002, 2004; Zhu and Sarkis, 2004; Zhu et al., 2004; Rao and Holt, 2005), South Korea began to perceive green management as a strategic priority. Since the economy heavily relies on export to the world, the government recognised that it has to take active actions toward green management movement. This realisation drove the South Korean government to pay careful attention to environmental practices for companies.

Korean government initiated to build a supply chain environment management programme that encourages participating companies from major industries to proactively address those green issues together. Under this programme, the Korean government launched "green partnership building project" for companies from July 2003 to June, 2006. Both large and small-medium companies that took part in this project came to build and launch GSCM in their respective companies with 75% budget support from the government for implementation.[1] Global Korean companies such as Samsung Electronics, POSCO, LG Electronics, Hyundai Automotive, and SK have embarked on GSCM vigorously since.

2.1.3 Partner's trust

Trust is the belief that there is no disadvantage in sharing information. Dyer (1997) defines trust as the mutual belief among business people that they will not take advantage of their partners. His study conducted an experiment to measure trust in the supplier-buyer relationship setting. Extending to supply chain level, trust among partner companies can be defined as the belief that cooperation and collaboration bring positive effects, not negative ones.

Trust in partners is the expectation that their actions will be positive, constructive, and not detrimental (Sako, 1991). Gulati (1995) differentiates such knowledge-based trust from deterrence-based trust. While deterrence-based trust is rooted in fear, knowledge-based trust is rooted in the confidence gained from information, and evolves over time.

Based on these studies, partner's trust is defined as the extent to which participants in supply chain are willing to count on each other for mutual interests and problem resolutions (Mentzer et al., 2001; Dyer and Singh, 1998; Kale et al., 2000).

2.1.4 Information sharing

In today's highly competitive, globalised, uncertainty-filled environment, companies have a particularly hard time making decisions; however, information sharing among companies can help to alleviate such uncertainty (Bensaou, 1997). Information sharing is one of the important factors in the supply chain and, accordingly, many studies on information sharing have been conducted (e.g., Dyer, 1996; Marien, 2000; Hur et al., 2004). Monczka and Morgan (1998) define information sharing as an official or unofficial sharing of valuable information among or within companies. Dyer (1996) defines information sharing as mutual sharing among suppliers, buyers, and others concerned. Drawing on these studies, information sharing is defined as the scope, frequency and intensity to which critical and proprietary information is communicated to participating entities (Christine et al., 2003; Zsidisin, 2003; Balsmeier and Voisin, 1996; Noble, 1997; Mentzer et al., 2001; Youn et al., 2008).

Information sharing can be further differentiated into risk and product information sharing. Risk information sharing involves making available to supply chain partners the current status of the inventory level, faulty materials, market volatility, transportation delay, limitations in production and purchases, and labour disputes. In an uncertainty prevailing environment, risk information sharing is crucial to effectively manage supply chains. Product information sharing includes knowledge about product records, new product development, break-up of products, and product quality. Product information sharing reduces uncertainty, clarifies targets, and increases timeliness (Hong et al., 2004).

2.1.5 Performance

Performance is a comprehensive construct to measure, especially in a supply chain setting. Gunasekaran et al. (2004) introduce the multi-facets of supply chain performance in six dimensions: order planning, supplier management, production effectiveness, product delivery performance, customer service, and return on investment. This study focuses on three dimensions of performance, namely, customer service, production effectiveness, and financial performance. Customer service and product effectiveness reflect the impact of green orientation, and financial performance shows the practical validity of green orientation for firms. Table 1 shows the definitions and literature base of each construct.

Table 1 Constructs definition and literature base

Constructs	*Definitions*	*Literature base*
Green Supply Chain Management orientation	A set of business philosophy and practices intended to control and support improvement of environmental results through supply chain	Godfrey (1998), Narasimhan and Carter (1998), Kainuma and Tawara (2006) and Zhu et al. (2008)
Partner's trust	The extent to which participants in supply chain are willing to count on each other for mutual interests and problem resolutions	Mentzer et al. (2001), Dyer and Singh (1998) and Kale et al. (2000)

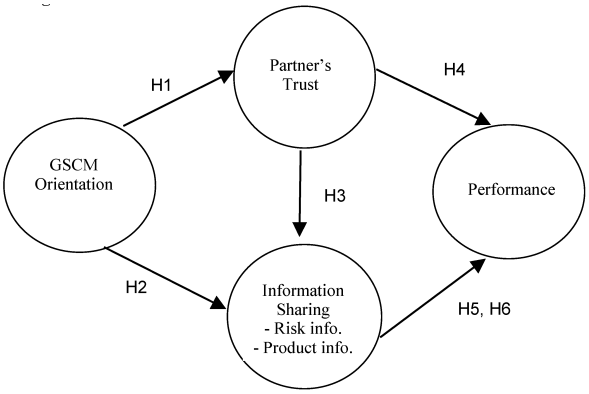
Table 1 Constructs definition and literature base (continued)

Constructs	*Definitions*	*Literature base*
Information sharing	The scope, frequency and intensity to which critical and proprietary information is communicated to participating entities	Christine et al. (2003), Zsidisin (2003), Balsmeier and Voisin (1996), Noble (1997), Mentzer et al. (2001), Li et al. (2005) and Youn et al. (2008)
Performance	The extent of outcome measures in terms of customers, processes and financial outcomes	Narasimhan and Jayaram (1998), Hewitt (1999), Gunasekaran et al. (2001) and Li et al. (2005)

2.2 Hypotheses

Figure 1 portrays a research model, which depicts how GSCM orientation impacts firm performance. Risk and partner information sharing and trust mediate between GSCM orientation and firm performance. The more a trustful relationship is built within a supply chain, the more information can be shared, which helps supply chain partners to convey green orientation through the supply chain and increase performance.

Figure 1 Research model



2.2.1 GSCM orientation and partner's trust

Green supply chain orientation aims at improving economic and environmental performance concurrently. This purpose drives firms to form a green supply chain where they purchase environmentally superior products and implement practices in accordance with ISO 14000 standards that are designed to minimise waste and increase operational efficiency. To successfully embed such practices into supply chains, it is critical for firms to help supply chain partners to develop such capabilities for sustainability in the form of training programmes and by transferring and sharing green knowledge (Cheng et al., 2008). This process of disseminating green orientation throughout a supply chain cannot be implemented without the trust that partners will not take advantage of such efforts but cooperate to produce positive outcomes (Spekman et al., 1998; Zhu and Cote, 2004; Dyer and Singh, 1998). Therefore,

H1: GSCM orientation is positively related to partner's trust.

2.2.2 GSCM orientation and information sharing

Seamless flow of information in scope, frequency, and intensity plays an essential role in supply chain management (Youn et al., 2008). Implementing green orientation often requires firms to share process knowledge with supply chain partners and standardise manufacturing and delivery practices. The more firms partake in green orientation, the more information sharing will flow in a supply chain including confidential information and product information (Cheng et al., 2008; Balsmeier and Voisin, 1996; Towill, 1997). Therefore,

H2: GSCM orientation is positively related to the sharing of partners' (a) risk information and (b) product information.

2.2.3 Partner trust and information sharing

Trust affects organisational learning and competitive advantage (Dodgson, 1993; Dyer and Singh, 1998) as well as the extent (Johnson et al., 1996; Inkpen and Beamish, 1997) and efficiency of knowledge acquisition (Kogut, 1988; Parkhe, 1993). When acquiring information from trustworthy partners, little time and effort is spent in screening and verifying the quality of information. Furthermore, Gulati (1995) suggests that in order to acquire more and better value from available information, information providers and information obtainers have to establish high transparency between them, meaning higher level of partner's trust. Without reliable inter-organisational relationships based on trust, commitment, and shared visions, firms will be reluctant to share information with their supply chain partners, given the fear of information spills and the resultant loss of power over competitors. Therefore,

H3: Partner's trust is positively related to the sharing of (a) the risk information and (b) the product information.

2.2.4 Partner trust and performance

Trust relationship with supply chain partners precedes effective customer service and the minimisation of wastes in production and delivery processes; lack of trust among suppliers and manufacturers impedes them from forming partnerships (Li and Lin, 2006), which increases uncertainty and decreases synergic cooperation in a supply chain. Once established, trust enables supply chain partners to utilise their resources more effectively, to lessen uncertainty in the communication and material transformation process, and to cope with abrupt changes and dangers more flexibly. For example, Metze (1997), after investigating successful companies, suggested that trust between partners played an essential role in integrating management team with an information system. Mariotti (1999) suggested credibility among channel members as a success factor in an effective supply chain system. Therefore,

H4: Partner's trust is positively related to (a) customer service performance, (b) operational effectiveness, and (c) financial performance.

2.2.5 Information sharing and performance

Seamless GSCM depends on how effectively information is shared among supply chain partners. Information sharing is one of five building pillars that solidify supply chain relationships, help firms to understand customers' needs, make the supply chain more responsive to market change, and increase operational efficiency (Lalonde, 1998; Stein and Sweat, 1998, Li et al., 2005). By sharing confidential information and product information such as transportation delay, faulty materials, labour disputes, and limitations in purchases, firms can have a broader view of the supply chain, making decision-making processes quicker and more accurate. Thus, information sharing is essential for achieving a stronger, more competitive supply chain (Christopher et al., 2004). Therefore,

H5: Risk information sharing with supply chain partners is positively related to (a) customer service performance, (b) operational effectiveness, and (c) financial performance.

H6: Product information sharing with supply chain partners is positively related to (a) customer service performance, (b) operational effectiveness, and (c) financial performance.

3 Research methods

3.1 Survey questionnaire

The survey questionnaires for this research were based on the existing literature. Instruments for GSCM orientation were adopted from Qinghua and Joseph (2004) and Narasimhan and Carter (1998). The partner's trust questionnaire was from Mentzer et al. (2001); the risk information sharing questionnaire was from Christine et al. (2003) and Zsidisin (2003). The product information sharing questionnaire was from Monczka and Morgan (1998). Supply chain performance measures take the green supply chain into account based on works by Narasimhan and Jayaram (1998), Hewitt (1999), and Gunasekaran et al. (2001). After translating the original questionnaire into Korean, minor modifications were made in order to improve the acceptance and understanding of survey respondents. All questionnaires were based on a seven-point Likert scale.

3.2 Data collection

An important issue in empirical research based on the survey questionnaire is selecting an appropriate group of respondents for data collection. In this study, the objects of analysis were manufacturers and distribution companies, which form the core of a supply chain network. Two conditions were applied when selecting samples: the companies that utilise SCM and SCM strategies and the companies that participate in the SCM specialty and expert training courses in various associations. The data collection process began with conducting telephone interviews with heads of relevant departments within listed companies and KOSDAQ-listed companies.

For three months, from June to September 2007, we contacted supply chain managers and explained the purpose of the research, and sent questionnaires by fax, e-mail, or regular mail to those who expressed interest in this study. Most of the contacts were managers of purchasing or manufacturing departments.

3.3 Sample characteristics

Of the 400 questionnaires sent to the target sample, 105 questionnaires were returned. 37 questionnaires were collected additionally by visiting companies in person, totalling 142 responses (35.5% of response rate). 17 responses had many missing values, which were excluded for hypothesis testing. Table 2 presents the sample characteristics.

Most of the companies (64%, 91 companies) were manufacturing companies, and in the supply chains, most of the companies were finished product assemblers (31%, 44 companies). The questionnaire responders were mainly managers or senior personnel (67.6%), that is, those who understand the company's overall situation.

Table 2 Sample characteristics

Classification		*Number of respondents*	*Percent*
Industry	Manufacturing	91	64.0
	Electronics and communication	13	9.2
	Logistic and services	38	26.8
	Total	*142*	*100.0*
Number of employees	Less than 50	65	45.8
	50–100	27	19.0
	100–500	21	14.8
	500–1000	7	4.9
	More than 1000	22	15.5
	Total	*142*	*100.0*
Position in the supply chain	Raw materials suppliers	16	11.3
	Component parts suppliers	22	15.5
	Component parts assemblers	11	7.7
	Finished products assemblers	44	31.0
	Logistic services providers	25	17.6
	Other service providers	24	16.9
	Total	*142*	*100.0*
Position and title of respondents	Supply chain specialist	17	12.0
	Assistant manger	29	20.4
	Manager	29	20.4
	Director	39	27.5
	Senior executives	18	12.5
	CEO	10	7.0
	Total	*142*	*100.0*

3.4 Data analysis

Structural Equation Modelling (SEM) was employed for data analysis in measurement and structural models, using Partial Least Squares (PLS 2.0 M3 Version). Similar to covariance-based SEM techniques (e.g., LISREL, EQS), PLS is a structural model tool that allows for testing causal models with multiple independent, mediating and dependent variables and with multiple indicators or measures per variable. PLS is particularly suited

to small-sample-size studies and exploratory analyses (Wold, 1985). The advantages in using PLS are its abilities to

a Handle multiple exogenous and endogenous constructs at the same time.

b Address multi-collinearity among endogenous constructs.

c Create latent construct scores directly on the basis of cross-products of multi-item measures (Hulland, 1999; Mahama, 2006). In addition, PLS does not assume any distributional assumptions (Chin, 1998).

4 Results for the measurement model

Confirmatory factor analysis was performed to evaluate the reliability and validity of values between measures and constructs (Hair et al., 1995). We evaluated the reliability using each item's loading in each construct (Appendix 2). All of the measured values were over 0.7 on each latent variable at the significance level of 0.001 (one-tailed test). The composite reliability values of each construct were all above 0.90, which meets the condition to be an adequate measure according to Nunnally (1978)'s recommendation.

Average Variance Extracted (AVE) assessed the convergent validity of the research model (Fornell and Larcker, 1981). If the AVE was more than 0.5, the convergent validity was considered to be adequate (Hair et al., 1995). All AVEs is well above 0.5, with the least one being 0.65. The discriminant validity can be tested by contrasting the square root of the AVE to the correction between two constructs. As Table 3 shows, the diagonal elements are the square root of the AVE, and the off-diagonal elements are the correlations between the constructs. The discriminant validity was achieved since all the diagonal values exceed the non-diagonal values (Hair et al., 1995; Fornell and Larcker, 1981).

Table 3 Descriptive statistics, AVE, Pearson correlation coefficients (n = 125)

Constructs	*Mean*†	*SD*†	*1*	*2*	*3*	*4*	*5*	*6*	*7*
GSCM orientation	4.160 (9 items)	1.398	**0.808**						
Risk information sharing	4.329 (6 items)	1.443	0.639*	**0.839**					
Product information sharing	4.621 (5 items)	1.398	0.549*	0.446*	**0.856**				
Partner's trust	5.036 (6 items)	1.167	0.493*	0.465*	0.446*	**0.870**			
Customer service performance	5.011 (5 items)	1.264	0.500*	0.586*	0.616*	0.702*	**0.922**		
Operational effectiveness	4.605 (5 items)	1.282	0.619*	0.633*	0.588*	0.578*	0.763*	**0.918**	
Financial performance	4.216 (4 items)	1.170	0.655*	0.514*	0.458*	0.492*	0.614*	0.763*	**0.917**

†Out of likert scale of 7 point.

*Correlation is significant at 0.01 level (two-tailed t-test).

Items in bold on the diagonal are the square root of the AVE figures; off-diagonal elements contains the squared correlations between constructs.

5 Structural model results

5.1 Hypothesis testing results

The validation of the measurement model warrants the validity of the structural model test. The analysis utilised a bootstrapping procedure with 500 samples with replacement in accordance with PLS analysis method (Wold, 1985). The analyses in Table 4 show that all hypotheses are supported except for H6c, the impact of product information sharing on financial performance. Panel A presents the direct path relationships between constructs, and Panel B indirect path relationships.

Table 4 Results from PLS analysis (n = 125): Trust → Share

Panel A: Direct effects – path coefficient, t-statistics and R^2						
Path from	*To partner's trust*	*Risk information sharing*	*Product information sharing*	*Customer service performance*	*Operational effectiveness*	*Financial performance*
GSCM orientation	0.494 (5.765)***	0.542 (7.288)***	0.435 (4.900)***			
Partner's trust		0.197 (2.166)***	0.231 (2.097)***	0.507 (5.199)***	0.334 (2.358)***	0.307 (2.703)***
Risk information sharing				0.146 (1.387)*	0.337 (3.235)***	0.291 (2.490)***
Product information sharing				0.285 (2.509)***	0.197 (1.405)*	0.113 (0.990)
R^2	0.617	0.438	0.342	0.617	0.522	0.352

Panel B: Indirect effects – path coefficient and t-statistics (Sobel's test)						
Latent variable	*Linkages*	*Product information sharing*	*Risk Information sharing*	*Customer service performance*	*Operational effectiveness*	*Financial performance*
GSCM orientation	Partner's trust	0.114 (1.971)**	0.097 (2.028)**	0.250 (3.828)***	0.165 (2.182)**	0.152 (2.447)***
Partner's trust	Risk information sharing			0.029 (1.168)	0.066 (1.800)*	0.057 (1.634)*
	Product information sharing			0.066 (1.609)*	0.045 (1.167)	0.067 (0.895)

*Significant at $p < 0.10$; **significant at $p < 0.05$; ***significant at $p < 0.01$ (one-tailed test).

Sobel's test is used when testing the statistical significance of indirect relationship between an independent construct and a dependent construct through a mediator (Preacher and Leonardelli, 2001). The test generates t-statistics and p-values for the indirect path.

We predicted that GSCM orientation would be positively associated with partners' trust. The structural path coefficient between GSCM orientation and partners' trust is statistically significant (completely standardised coefficient = 0.49, t = 5.77), thus

providing support for H1. GSCM orientation also exhibits strong impact on risk information sharing (completely standardised coefficient = 0.54, $t = 7.29$) and on product information sharing (completely standardised coefficient = 0.44, $t = 4.9$). As predicted, these results indicate that the successful implementation of GSCM requires solid trust relationship and information sharing practices.

Hypothesis 3a and 3b predicted a positive relationship between partner's trust and risk and product information sharing. The paths between partners' trust and information sharing are significant and in the predicted direction. This provides support for prior research findings that inter-organisational trust has been recognised as an important enabler in building effective information sharing in supply chain management (Spekman et al., 1998; Li and Lin, 2006).

The path coefficients between partner's trust and performances are statistically significant, supporting H4 (H4a, H4b, H4c). These results provide support for prior research that inter-organisational trust is related with positive economic performance such as increased competitive advantage, reduced transaction cost, and augmented satisfaction (Barney and Hansen, 1995; Zaheer and Venkatraman, 1994; Geyskens et al., 1998). It also supports Hypotheses H5a, H5b, and H5c, that risk information sharing has a positive effect on customer service performance, operational effectiveness, and financial performance. Regarding the relationships between product information sharing and performance, preliminary support was found for Hypotheses H6a and H6b, but its impact on financial performance (H6c) was not supported. We found the results on the association between the information sharing and performance to be consistent with prior research (Huang and Gangopadhyay, 2004).

Moreover, the possibility of a relationship between partners' trust and the indirect effect of information sharing was investigated, and the indirect effect of green management cooperation, performance, and the trust accumulation of partners was statistically significant. However, regarding the indirect effect of information sharing, risk information sharing has statistically significant relationship with operational effectiveness and financial performances. Product information sharing among partners, however, has significant relationship only with customer service performances (see Panel B, Table 4).

5.2 Additional analysis

GSCM orientation is shown to affect the relations among customer service, operational effectiveness, and financial performance. However, the marketing literature views information sharing as a factor that helps firms to accumulate mutual trust among partners. A post-hoc analysis was conducted to determine whether or not information sharing affects partner's trust in green management context or the other way around.

The analysis shows that the path coefficients for both risk information sharing and product information sharing are not significantly related to raising the partners' trust (see Appendix 3, Panel C). It was examined whether or not information sharing has indirect effects on SCM performances via increased partner's trust, and the results indicate that the indirect effects are statistically insignificant (see Appendix 3, Panel D). Information sharing helps companies and customers to build their mutual trust. When it comes to the green management context where top managers make strategic decisions, however, a trust relationship has to be established first to share confidential and critical information with partners. Since green management decisions are often strategic by

nature, managers tend to not make core information available to partners unless they have already accumulated a high level of trust with partners.

6 Discussions

Recent environmental regulations initiated in many parts of the world and customers' interests in green environment have directed firms to approach green supply management from a strategic perspective. Green management is more than another stringent directive and it demands the capability to provide manufacturers and consumers with incentives to minimise wastes and to maximise sustainability. Firms have attempted to curtail wastes and pollutants by embedding environment-friendly design process into product development phase, which required substantive planning and collaboration far ahead of product design stage. This collaborative and strategic partnership with upstream and downstream supply chain partners aims to improve economic and environmental performance of a supply chain at the same time (Ansari and Bell, 1997).

This study defines GSCM orientation and verifies whether or not it helps firms to improve financial and organisational performance. We posited that partner's trust and information sharing will be mediating the impact of GSCM orientation. Six hypotheses were developed and analysed using the data from Korean firms. The results stress two things. First, green management improves firm performance. Although green management reportedly has a positive influence on firm performance, it requires firms to reshape organisational culture to be green- and efficiency-friendly. Furthermore, implementing GSCM demands firms to invest their resources to minimising pollutants and wastes and expanding managerial expansions to recyclability of the products. This demands neither minor effort nor little commitment. Such commitment makes firms reluctant to shift to green management. This research shows that green orientation results in positive influence on increasing firm performance including customer service, operational effectiveness, and financial outcomes.

Second, trust and information sharing mediates the influence of GSCM orientation on firm performance. This study shows that building trust relationship precedes information sharing among partners. This result contradicts the notion that trust among organisations can be accumulated when information is actively shared among partners. The additional analysis exhibited that information sharing does not help cultivating trust relationship. When it comes to green management, information sharing is a strategic matter. To ensure green knowledge transfer, trust relationship should be built up first.

This study also makes three contributions to the extant literature. First, this study extended the scope of green management study by defining GSCM orientation and examining its impact on firm performance. The empirical results confirmed that green management increases firm performance. Second, this study showed the noticeable relationships among partner trust, information sharing and performances. Cultivating trust relationship among suppliers, distributors and customers helps firms to deliver and spread their green management orientation throughout the supply chain. Third, this research enriched information sharing practices and firm performance in the green management perspective. Information sharing was classified to risk information sharing and product information sharing, and performance was differentiated to customer service performance, operational effectiveness, and financial performance. The interaction

among these variables gives detailed understanding on the impact of green management orientation.

7 Implications and future research

7.1 Implications for Green Supply Chain Management

From the results of this study we can draw several insights in conducing GSCM. First, the higher the green management orientation, the higher the three dimensions of firm performance (i.e., customer service, operational effectiveness, and financial performance). Despite financial burdens of conducting GSCM, firm performance increases when the green orientation is effectively implemented. Considering that this empirical study is based on South Korean firms, this finding indicates that firms' awareness on green movement is spreading to Eastern Asia and that firms are actively reacting to the green pressure. Second, implementing green management requires important information from partners, effecting information sharing and, thereby, enhancing partner trust. It is not general product information sharing but risk information sharing that improves firm performance. This result offers managers the insight that corroborating trust relationship among partners paves the way for information sharing, not the other way around.

7.2 Implications for managers

For managers, this research suggests that solid trust relationship need to be established and tested among supply chain partners in the course of pursuing GSCM. Strategically defining the nature of partner relationships helps firms to determine the degree of collaboration and information sharing. This insight may help managers to clear their concerns about making investments into environmental issues with their partners. It is desirable for firms to maintain tight partnerships since environmental issues often occur sporadically and unexpectedly. Thus, building a green supply chain is about changing supply chain culture to long-term collaboration. Indeed, it takes a long time to build up trust in a supply chain network. By entering trust relationship with supply chain partners, firms can cultivate organisational culture where confidential and sensitive information can be securely transferred and shared. In this regard, going green is about changing a supply chain rather than changing a management tool.

7.3 Future research direction

Past researches on sustainability have studied the issues of product design and producer's responsibility. This research has shed light on the process of increasing environmental performance from trust and information sharing perspective. As firms broaden common understanding on environmental issues and enrich trust relationship for information sharing, strategic partners will reflect environmental concerns together and improve green performance better. While environmental management researches have mainly dealt with environment policy, regulation and financial performance, this research has added another perspective to the literature from the relationship and information sharing standpoint. Since this study is based on South Korean firms, there is a need to confirm the

research framework in a broader region. It will be also interesting to see differences that various contexts will bring to trust and information sharing. For example, in automobile industry, a supplier could supply components to more than one manufacturer. In this case, it could be risky to share confidential green knowledge with suppliers. In this co-copetition situation, building a trust relationship may not be as easy and information sharing practices may take different forms. Future research may further explore these various aspects of GSCM.

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Note

[1]A study in 2003 compared the level of GSCM in Korean companies with that of developed countries and reported that green purchasing, standardisation in industry, and information sharing and collaboration among jobs account for 70%, 58%, and 25% of developed countries, respectively (Korea MCIE, 2006).

Appendix 1: Survey questionnaire

1 Green supply chain management orientation

- Does the purchasing department consider the environment (green purchasing, etc.)?
- Are environment-friendly techniques such as recycling, reuse, and use of alternative, non-hazardous substances applied when producing products (providing services)?
- Is any restructuring among departments planned to improve environment related problems?
- Does the CEO have an interest in green management?
- Are environment-friendly practices (such as in design, construction, packaging, etc.) incorporated into efforts to sell (or buy) products or provide (or use) services?
- Are companies restricted by client companies in green management terms?
- Do companies measure and distribute environmental costs?

- Have companies ever discontinued business with customer companies as a result of green management issues?
- Does green management enhanced company brand image?

2 Partner's trust

- Partner companies duly perform agreed-upon work.
- Partner companies undertake predictable activities.
- Partner companies are considered to be eligible in a given field.
- Partner companies' decision-making helps our company, and the performance result is reliable.
- Partner companies' duly negotiate to reach mutual satisfaction.
- Partner companies duly respond to our company's requests, and take on unfavourable responsibilities depending on situations.

3 Risk information sharing

- Inventory insurance, risk information associated with maintenance management.
- Risk information regarding supply or provision of faulty products, materials (or services).
- Risk information regarding market volatility (price, technique, design, etc.).
- Risk information regarding transportation methods (transportation delay, distribution channel risks, transportation amounts, etc.).
- Risk information regarding capability limitations (purchasing capability of buyers, production capability of sellers).
- Other risk information (labour disputes, information distortions, natural disasters, etc.).

4 Product information sharing

- Information on delivered products, sales records of services (or provision or purchasing records).
- Information on product or service modification such as design, colour, shape.
- Information on sales records of product or service.
- Information on new product and service developments.
- Information on delivered products and inventory-related services.

5 Customer service performance

- Information sharing between partner companies helps enhance the flexible confrontational ability in the market.

- Information sharing among partner companies helps service provision and timely delivery.
- Information sharing among partner companies helps improve the quality of product services.
- Information sharing among partner companies helps improve customer trust.
- Information sharing among partner companies helps improve the quality of product or service.

6 Operational effectiveness

- Information sharing among partner companies helps shorten working hours and variable lead-time.
- Information sharing among partner companies helps reduce production cycle times and new-product cycle times (development cycles).
- Information sharing among partner companies helps reduce production or operational costs.
- Information sharing among partner companies helps improve asset efficiency (properties).
- Information sharing among partner companies helps reduce inventory and improve inventory cycles.

7 Financial performance

- Information sharing among partner companies improves cash flow.
- Information sharing among partner companies increases total sales.
- Information sharing among partner companies increases ROI.
- Information sharing among partner companies increases the financial revolving rate.

Appendix 2: Measurement model

Constructs	*Items*	*Factor1*	*Factor2*	*Factor3*	*Factor4*	*Factor5*	*Factor6*	*Factor7*
Green Supply Chain Management orientation	Item 1	0.8320						
	Item 2	0.8089						
	Item 3	0.8035						
	Item 4	0.8298						
	Item 5	0.9014						
	Item 6	0.7886						
	Item 7	0.8443						
	Item 8	0.7654						
	Item 9	0.8302						

Appendix 2: Measurement model (continued)

Constructs	*Items*	*Factor1*	*Factor2*	*Factor3*	*Factor4*	*Factor5*	*Factor6*	*Factor7*
Risk information	Item 1		0.8742					
	Item 2		0.8702					
	Item 3		0.8024					
	Item 4		0.8311					
	Item 5		0.8829					
	Item 6		0.7655					
Product information	Item 1			0.8521				
	Item 2			0.8926				
	Item 3			0.8772				
	Item 4			0.8223				
	Item 5			0.8314				
Partner's trust	Item 1				0.8909			
	Item 2				0.8483			
	Item 3				0.8903			
	Item 4				0.8558			
	Item 5				0.9054			
	Item 6				0.8274			
Customer service performance	Item 1					0.9029		
	Item 2					0.9029		
	Item 3					0.9531		
	Item 4					0.9487		
	Item 5					0.9408		
Operational effectiveness	Item 1						0.9156	
	Item 2						0.9298	
	Item 3						0.9081	
	Item 4						0.9089	
	Item 5						0.9243	
Financial performance	Item 1							0.8955
	Item 2							0.8922
	Item 3							0.9406
	Item 4							0.9387
Composite reliability		0.9437	0.9342	0.9317	0.9492	0.9661	0.9548	0.9548
Average variance extracted		0.6528	0.7036	0.7319	0.7571	0.8509	0.8416	0.8410
Cronbach alpha		0.9320	0.9120	0.9080	0.9360	0.9560	0.9230	0.9370

Appendix 3: Results from additional PLS analysis (n = 125): Share → Trust

Panel C: Direct effects – path coefficient, t-statistics and R^2

Path from	*To risk information sharing*	*Product information sharing*	*Partner's trust*	*Customer service performance*	*Operational effectiveness*	*Financial performance*
GSCM orientation	0.639 (10.891)***	0.549 (7.370)***	0.306 (2.369)***			
Product information sharing			0.143 (1.074)	0.146 (1.309)*	0.337 (3.121)***	0.291 (1.074)
Risk information sharing			0.175 (1.220)	0.206 (2.372)***	0.197 (1.335)*	0.113 (0.995)
Partner's trust			–	0.507 (4.823)***	0.334 (2.533)***	0.307 (2.563)***
R^2	0.409	0.302	0.296	0.617	0.522	0.352

Panel D: Indirect effects – path coefficient and t-statistics (Sobel's test)

Latent variable	*Linkages*	*Partner's trust*	*Customer service performance*	*Operational effectiveness*	*Financial performance*
GSCM orientation	Product information sharing	0.096 (1.205)	0.156 (2.258)**	0.108 (1.314)	0.062 (0.986)
	Risk information sharing	0.097 (1.069)	0.091 (1.300)	0.212 (3.00)***	0.183 (2.612)***
Product information sharing	Partner's trust		0.089 (2.126)**	0.058 (1.730)*	0.054 (1.740)
Risk information sharing	Partner's trust		0.073 (1.048)	0.048 (0.989)	0.044 (0.991)

*Significant at $p < 0.10$; **significant at $p < 0.05$; ***significant at $p < 0.01$ (one-tailed test).

Sobel's test is used when testing the statistical significance of indirect relationship between an independent construct and a dependent construct through a mediator (Preacher and Leonardelli, 2001). The test generates *t*-statistics and *p*-values for the indirect path.