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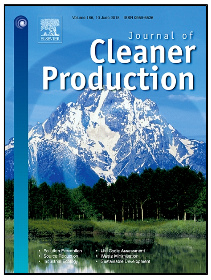

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Abstract

Using an international survey, this study examines the drivers and consequences of green supply chain management (GSCM) practices. Building on the GSCM literature, we propose that cost and customer drivers influence internal and external green practices and enhance environmental performance. Based on a study of 246 companies in multiple countries, the results indicate that both cost drivers and customer drivers significantly influence internal and external green practices, which in turn contribute to environmental performance. Moreover, the impacts of cost and customer drivers on internal and external green practices are influenced by firm size: the impacts of cost drivers are greater for large firms than for small firms, while those of customer drivers are lower for large firms than for small firms. Our findings have both theoretical and managerial implications for the GSCM literature and practice.

Keywords: customer driver, cost driver, green supply chain management, high-performance manufacturing

1. Introduction

The notion of green practices has become strategic important for many companies. Due to the increased concern about environmental sustainability, green practices are emphasized not only by governments but also by companies (Mitra and Datta, 2014). Globalization has also extended the scope of green practices. As firms rely more on their supply chain partners to obtain competitive advantage, green practices have been extended from single firms to the supply chain (Ghadimi et al., 2015; Zhu and Sarkis, 2004). For example, a Hong Kong toy manufacturer went bankrupt because it was sued by its US customers for using toxic paints purchased from a supplier (Ang, 2007). Accordingly, an increasing number of firms, especially large multinational corporations, are experiencing greater pressure from stakeholders to incorporate green practices into operations and supply chain practices (Rueda et al., 2017; Wilhelm et al., 2016; Zhu et al., 2017).

In line with this trend, many studies have been conducted to understand the antecedents and results of green practices in terms of companies' economic and environmental performance (Sharma and Vredenburg, 1998; Subramanian and Gunasekaran, 2015; Walker et al., 2008). These studies address the concept of green supply chain management (GSCM), which is defined as the application of environmental management principles to the entire set of supply chain activities, including design, procurement, manufacturing, assembling, packaging, logistics, and distribution (Handfield et al., 1997). In a thorough literature review by Walker et al. (2008), internal and external drivers and barriers to GSCM practices are identified in prior studies. Although great progress has been made concerning the drivers of GSCM practices in recent years, several issues remain unresolved. First, there are few studies on the cost considerations driving GSCM practices; existing studies focus on outside pressures, such as the government and customers (Yu and Ramanathan, 2015). These few studies are case-based, and there is a need for further investigation of the impact of cost drivers conducted with a large sample. Second, very few studies have investigated the cost and customer motivations for GSCM implementation simultaneously. It would be interesting to understand how cost and customer drivers individually and simultaneously influence GSCM practices (Sarkis et al., 2011). Finally, extant studies focus on various drivers of GSCM practices with limited consideration of their contingent effects of firm characteristics. For example, there are debates on "whether SMEs are able to do good-enjoy high social and environmental performance – given their struggles to do well – to even survive given the high failure rate" (Arend, 2014). As such, a comparative study of large and small companies is needed to examine these firms' differences in adopting GSCM practices.

To fill the gap, this study builds a holistic model that includes cost and customer drivers, GSCM practices, and environmental performance. Using a large international survey of high-performance manufacturing, we test the individual and interactive effects of cost and customer drivers on internal and external GSCM practices. Then, we test the impact of internal and external GSCM practices on environmental performance. Further, we test the moderating effect of firm size on the above relationships.

2. Theoretical background and conceptual model

2.1 GSCM

There exist various definitions of GSCM (Ahi and Searcy, 2013) and, therefore, discussions of different components of GSCM in the literature. For example, Wang et al. (2014) conducted case research on five areas of GSCM: material, product design processes, supplier process improvement, supplier evaluation, and inbound logistics processes. Zhu and Sarkis (2006) focused on internal environmental management, green purchasing, cooperation with customers in terms of environmental requirements, investment recovery, and eco-design practices. In summary, different classifications of GSCM emerge in the literature based on different research purposes.

In this study, we attempt to investigate the roles of cost and customer drivers of GSCM practices, which represent the internal and external considerations, respectively, that motivate GSCM. In accordance with Walker et al. (2008), firm boundaries are used to classify GSCM practices. Thus, in this paper, GSCM includes internal and external green practices. Internal green practices focus on the company-wide green activities concerning mainly the eco-design of internal processes. External green practices focus primarily on green collaboration with suppliers.

2.2 Customer and cost drivers of GSCM

To identify and classify GSCM drivers, a systematic literature review was conducted according to the method of Tranfield et al. (2003). By searching reputable journals in operations and sustainability using keywords, a list of related papers was identified. Using reputable journals in operations and sustainability enables quality assessment. Then, a content-based method was used to examine these research works and classify the drivers of GSCM (Gosling et al., 2017). Appendix A shows our selected recent studies concerning GSCM drivers.

Different kinds of internal and external drivers of GSCM are discussed in the literature (Agi and Nishant, 2017; Somsuk and Laosirihongthong, 2017; Walker et al., 2008). These drivers explain why companies should engage in GSCM practices to some extent. The most frequently emphasized external drivers are regulatory concerns, customers, competition, society, and suppliers (Lo and Shiah, 2016; Motohashi, 2015; Vanalle et al., 2017), which have been investigated in many descriptive and quantitative research (Lo and Shiah, 2016; London and Hart, 2004; Walker et al., 2008). In contrast, internal drivers have been less investigated in the existing GSCM literature. For example, several studies have focused on organizational-level internal drivers, such as company reputation, top management support, and strategic orientation (de Guimarães et al., 2018; Lo and Shiah, 2016; Tachizawa et al., 2015). A few papers have discussed other internal drivers, including employees' commitment and operational focus in terms of cost reduction, waste reduction, and quality improvement (Dües et al., 2013; Mollenkopf et al., 2010; Motohashi, 2015). In these few studies, cost drivers are investigated only through descriptive cases, which is not consistent with the recent supply chain management literature, which focuses on the cost issue since managers have mastered the skills to reduce costs and know how to allocate resources to cost reduction. Although efficiency improvement is an ongoing activity for most firms, there is limited empirical evidence on the role of cost drivers in GSCM practices. It seems that efficiency considerations are generally neglected when companies combine supply chain management with green practices, which may be because the implementation of GSCM practices is usually required by stakeholders. It often costly to respond to these stakeholders' requirements. Walker et al. (2014) explained that managers may not be willing to invest firm resources in green practices due to the short-term costs, even though long-term cost savings are expected from waste reduction and closed-loop systems.

From an operations perspective, we consider customer and cost drivers of GSCM practices in this study. Both internal and external GSCM practices may be driven by internal and external pressures. Cucchiella et al. (2012)'s GSCM typologies indicate that companies may adopt different internal and external GSCM practices based on internal and external pressures. Furthermore, the impacts of customer and cost drivers may differ for firms of different sizes, which suggests that small companies may have a lower motivation to engage in green practices due to their limited resources (Bose and Pal, 2012; Lee and Klassen, 2008). Figure 1 shows the proposed model.

<<<<<<Insert Figure 1 about here>>>>>

3. Hypotheses development

3.1 Drivers of green practices

In the literature, customers are the most important factor leading to environmental management practices (Walker et al., 2008). From a supply chain perspective, manufacturers respond to customers' green requirements by not only improving their internal processes but also collaborating with suppliers in green activities (Sarkis et al., 2011; Tachizawa et al., 2015; Zhu et al., 2012). Customers can motivate firms to adopt green practices by exerting pressure on the company (Jayaram and Avittathur, 2015), as customers have the market power to facilitate the application of green practices. For example, to acquire orders from customers, manufacturers must behave according to the quality standards in environmental issues, e.g., ISO 14000. Customers can also drive green practices by educating their supply chain partners. Manufacturers may learn green practices from their customers and manage their own processes and collaborations with suppliers, a process called "supply chain contagion" in the supply chain literature (McFarland et al., 2008). It is conjectured that imitated behavior will also be popular, given the boom in supply chain management. This behavior is also consistent with the diffusion of innovation theory arguments in the GSCM literature (Sarkis et al., 2011). Customers are externally oriented drivers of the application of green supply chain practices.

The existing literature provides general empirical support for customers' role in driving green practices. However, there are also mixed links between customer drivers and green practices. For example, Agan et al. (2013) supported the path from customer drivers to green practices in design and environmental management systems; however, the path from customer drivers to recycling practices was not supported in their study. Additionally, Lin and Ho (2011) found a non-significant impact of customer pressure on green practice adoption in Chinese logistics companies. Thus, more sample tests are needed to determine the role of customer drivers. Following the general understanding of the role of customer drivers, we propose the following:

H1a: Customer drivers are positively related to external green practices.

H1b: Customer drivers are positively related to internal green practices.

Most of the literature shows that costs remain a dominant issue in implementing green practices (Abbasi and Nilsson, 2012). However, few studies discuss the role of cost drivers in GSCM (Walker et al., 2008). From the purchasing management perspective, it has been argued that environmentally friendly product purchasing would greatly increase the costs and reduce the competitiveness of the buying company (Min and Galle, 1997). Companies pursuing a green purchasing strategy may need to invest in employee training and environmental auditing. However, the literature also finds that great opportunities for cost savings exist when conducting green practices, such as waste separation and recycling from the beginning of the sourcing process (Min and Galle, 2001). Combing supply chain management and green practices provides a good opportunity to reduce costs and address environmental concerns simultaneously (Zhu et al., 2012). The overall cost savings along the supply chain may surpass the initial investment required to start an environmental program. The previous literature proposed that long-term and life-cycle analysis of costs will facilitate the successful running of an environmental program (Carter and Dresner, 2001). An analysis of green practices in the whole value chain redefines the role of cost reduction in environmental programs (Handfield et al., 1997). If they bear in mind that costs of green practices can be mitigated, managers will be more likely to implement internal and external green practices. Case evidence also shows that costs could be a driver of green practices, although there is less evidence on cost drivers than there is on customer drivers (Walker et al., 2008). From the supply chain perspective, we propose the following:

H2a: Cost drivers are positively related to external green practices.

H2b: Cost drivers are positively related to internal green practices.

3.2 Green practices and performance

Many studies have been conducted to investigate the impact of green practices on firm performance (e.g., Mitra and Datta, 2014; Tachizawa et al., 2015; Vanalle et al., 2017; Zhu and Sarkis, 2004). In this study, we focused on environmental performance. From the environmental management perspective, environmental performance is a key indicator for evaluating the impacts of green practices on performance (Zhu et al., 2012). Environmental issues have also attracted great concern worldwide. There are many examples of the neglect of environmental performance when pursuing improvements in economic performance. Both internal and external green practices can improve environmental performance (Zhu et al., 2013). Companies adopting internal green practices will reduce their potential environmental pollution by using safe materials, recycling disposable parts, or properly dealing with exhausted machinery. Companies can also reduce the potential harm to the environment by collaborating with suppliers in green practices.

The literature shows inconsistent findings on the performance impacts of internal and external green practices. Most of the literature supports the positive impacts of green practices on environmental performance (Yang et al., 2013; Zhu and Sarkis, 2004), but some green practices, such as green purchasing or eco-design, have negative or nonexistent performance impacts (Zhu et al., 2007, 2013). Most of these studies have been conducted in one country or one specific industry. Investigating these issues in multiple industries and multiple countries would increase the generalizability of the findings. Following the outcomes of the mainstream literature, we propose the following:

H3: External green practices are positively related to environmental performance.

H4: Internal green practices are positively related to environmental performance.

3.3 Moderating effect of firm size

Customer drivers represent buying power in the supply chain context. According to resource dependence theory, power is formed through the interdependence between supply chain partners (Pfeffer and Salancik, 2007). Customers can exert their power by influencing focal firms' behavior in GSCM (Carter and Rogers, 2008). As the focal firm increases in size, customers' likelihood to exert their power decreases. Because of their buying power, customers can require focal firms to pursue sustainability, and thus, focal firms must conduct internal and external green practices to respond to customers' needs. Compared with small firms, large focal firms will be less influenced by buyer power, as large firms have more power than small firms. Thus, focal firms' dependence on customers will decrease as firms become larger. Thus, large firms are less likely to be influenced by customers when implementing green practices.

H5a/b: The impact of customer drivers on internal/external green practices will be weaker for large firms than for small firms.

Large firms have advantages in economies of scale (Moch and Morse, 1977). Compared with small firms, the average overhead cost per unit will be lower for large firms (Baumann-Pauly et al., 2013). On one hand, when investing in green practices, large firms could break even more quickly than small firms. It has been observed that environmental programs are considered a heavy economic burden for small firms (Leonidou et al., 2016; Tilley, 1999). On the other hand, the cost savings from green activities will be greater for large firms than for small firms. Thus, cost drivers will be more economically attractive for large firms than for small firms. Moreover, cost savings in green activities could include visible and invisible cost savings. Visible cost savings could be found in lower reworking, the recycling of materials, or the reuse of machinery. Invisible cost savings can be found in the firm's reputation as a green product provider, environmentally friendly social recognition, or the lower risk of punishment for misconduct. Large firms will be more sensitive to the risk of costs due to the decreased reputation for providing green products or punishment for misconduct in polluting the environment. It has been suggested that adopting a long-term and life cycle analysis perspective on the costs of environmental program would lead to success (Carter and Dresner, 2001). Thus, we propose the following:

H6a/b: The impact of cost drivers on internal/external green practices will be stronger for large firms than for small firms.

4. Research methodology

4.1 Sampling and data collection

Data were collected as part of the research efforts for the fourth High Performance Manufacturing (HPM) Project, which was undertaken in 2012. The HPM project is a large-scale, multi-country, multi-industry research project conducted by a team of international researchers and designed to comprehensively assess a manufacturing plant's operations and their impacts on plant performance with global competition since 1991 (Mishra and Shah, 2009; Naor et al., 2010). Rigorous translation-back-translation is used in this standardized survey to ensure the equivalence and comparison of survey items across countries (Mullen, 1995). Data were collected from plants in three industries: machinery, electronics and transportation components, as defined at the four-digit SIC code level. There were twelve questionnaires in this survey, and each was completed by two respondents from the same area in one plant. For this study, we use the questionnaire for environmental affairs. The respondents for environmental affairs included environmental affairs managers and compliance managers, who were knowledgeable on the plant's environmental operations. A central coordinator cleaned the data collected in the participating countries and distributed the final dataset to the leaders of this project in the participating countries. In the final dataset, the value for each item is the average value of the two responses from one plant. The fourth-round data collection yielded a total useable set of 304 responses from manufacturing plants located in 13 countries/regions. For the present study, we deleted the samples with missing values on environmental affairs or on employee numbers. We ultimately obtained a dataset with 246 responses. Table 1 shows the profiles of the samples.

<<<<<<Insert Table 1 about here>>>>>

4.2 Measures

Customer drivers, cost drivers, external green practices, internal green practices and environmental performance were assessed using multiple items on a 5-point Likert-type scale. The scales were adopted or adapted from previous studies and are listed in Table 2. Customer drivers were measured using four items adapted from Carter and Jennings (2004) to capture the external pressures firms face when adopting GSCM. Cost drivers, which indicate the internal reasons for firms to facilitate GSCM, were measured by four items adapted from (Carter and Dresner, 2001), Melnyk et al. (2003), and Holt and Ghobadian (2009). External green practices were measured by five items adapted from Handfield et al. (1997) and Zhu and Sarkis (2006). The measures of internal green practices were adapted from Zhu and Sarkis (2004). Industry was included as a control variable for environmental performance, since the industry structure may strongly affect environmental performance (Zhu et al., 2008a). We also included countries/regions to control the possible effects of economic differences on environmental performance. To further investigate the moderating effects of firm size, a group of small firms and a group of large firms are formed based on firm size, as measured by the number of employees. Firms with fewer than 500 employees were classified as small firms, and those with more than 500 employees were classified as large ones (Koufteros et al., 2007). Finally, we have a group of 148 small manufacturing firms and one with 98 large manufacturing firms.

<<<<<<Insert Table 2 about here>>>>>

4.3 Common method variance

Three remedies were applied in our study to reduce common method variance. First, in the survey, we randomly arranged the measurement items in different sections of the questionnaire (Podsakoff et al., 2003). Second, the measurement items were assessed using questions in various formats to create a methodological separation of the independent and dependent variables (Craighead et al., 2011). Specifically, although all variables (except firm size and control variables) were measured on a 5-point Likert scale, 1 and 5 actually indicated different meanings for different questions, and the questions were asked in different ways. Third, we obtained responses from two managers in the same plant for the same questions and used the averaged values, which also helped reduce common method bias. Then, statistically, we conducted Harman's single-factor test (Podsakoff et al., 2003) and found that no single factor accounted for most of the covariance. In addition, there were no excessively high correlations, indicating that common method variance is not a serious concern (Pavlou et al., 2007).

5. Analyses and results

In this study, we used the partial least squares (PLS) approach to structural equation modeling (SEM). This technique, which has been widely used in business research in such areas as information systems, marketing, and operations management (Peng and Lai, 2012), has a strong capacity to handle complex models with relatively small sample sizes (Hair et al., 2013). To compare large and small firms, we had two groups with 148 and 98 firms, respectively. The relatively small sample size in each group validates the use of the PLS-SEM technique. Both the structural model and its measurement model can be assessed with the PLS-SEM technique. In this study, SmartPLS software (3.2.1 version) was used to assess the measurement and structural models (Ringle et al., 2015).

5.1 Measurement model

Cronbach's alpha is used to assess the reliability of all the constructs, and the values for the whole dataset range from 0.806 to 0.938 (Table 3), which are all above the 0.70 threshold value recommended by Nunnally and Bernstein (1994). The

Cronbach's alpha values for all constructs in the sub-groups also satisfy this requirement, indicating that all the constructs are reliable.

Since most items in our model are adapted from previous studies, content validity is ensured. An international group of senior researchers also provided a contribution to ensure content validity. We employ the factor loadings, composite reliability, and average variance extracted (AVE) of all items to assess convergent validity. The factor loadings for the measures based on the whole dataset range from 0.733 to 0.948 (Table 2), exceeding the 0.7 threshold value recommended by Fornell and Larcker (1981). The factor loadings for the measures in the sub-groups are all above 0.7, except for one item in each sub-group. The values of composite reliability for the whole dataset range from 0.872 to 0.955 (Table 3), which are all above the 0.70 threshold value recommended by Nunnally and Bernstein (1994). The composite reliability values for all constructs in the sub-groups also satisfy this requirement. AVE is also assessed based on the suggestion from Fornell and Larcker (1981). The AVE values for the whole dataset range from 0.631 to 0.843, exceeding the recommended threshold value of 0.5. The AVE values of all constructs in the sub-groups also satisfy this requirement. These three assessments indicate adequate convergent validity for all constructs.

<<<<<<Insert Table 3 about here>>>>>

Further, we assessed the discriminant validity by comparing the square root of each construct's AVE with its coefficients of correlation with other constructs. If the square root of a construct's AVE is the largest when compared with its correlation coefficients with other constructs in this model, the construct has sufficient discriminant validity (Fornell and Larcker, 1981). Table 4 shows that all constructs in our model satisfy this requirement, indicating adequate discriminant validity.

<<<<<<Insert Table 4 about here>>>>>

5.2 Structural model

The path loadings and R^2 values were assessed in with a PLS path model (Peng and

Lai, 2012). The strength of the relationships between the independent and dependent variables can be assessed with path loadings. The R^2 value, which shows the amount of variance explained by the independent variables, indicates the predictive power. The results of the structural model using the whole dataset are shown in Figure 2. The bootstrap estimates presented here are based on 5000 bootstrap samples, and this model explains 24.3% of the variance in environmental performance, 33.8% of the variance in external green practices, and 31.1% of the variance in internal green practices. We also use an absolute measure of model fit criterion, the standardized root mean square residual (SRMR), to measure the model's goodness of fit (GoF) (Henseler et al., 2014). The results show that SRMR values for the whole dataset, the small firm group and the large firm group were 0.056, 0.060, and 0.079, respectively. These SRMR values are below the recommended threshold value of 0.08, indicating a satisfactory model fit. GoF values of the whole dataset, the small firm group and the large firm group were 0.4609, 0.4675, and 0.4795, respectively, indicating a satisfactory model fit (Wetzels et al., 2009).

The results show that customer drivers have positive effects on external green practices ($b=0.468$, $P<0.001$) and internal green practices ($b=0.410$, $P<0.001$), indicating that higher customer drivers will facilitate a firm's external and internal green practices. These findings provide support for H1a and H1b. Cost drivers also have positive effects on external green practices ($b=0.221$, $P<0.01$) and internal green practices ($b=0.264$, $P<0.001$), supporting H2a and H2b. The results also show that environmental performance is positively affected by external green practices ($b=0.267$, $P<0.01$) and internal green practices ($b=0.248$, $P<0.05$). Hence, H3 and H4 are supported. Additionally, the results indicate that the differences across industries and the differences in environmental performance between developing and developed economies are insignificant. The electronics and transportation component industries have better environmental performance than the machinery industry.

We applied a non-parametric approach – PLS-based multi-group analysis (PLS-MGA) – to investigate the moderating effects of firm size (Henseler et al., 2009). Figure 3 shows the bootstrap estimates of the structural model based on two subsamples. The results of the comparison are shown in Table 5 and indicate that for the group of small firms, customer drivers have positive effects on external green practices (b=0.526, P<0.001) and internal green practices (b=0.482, P<0.001). Cost drivers also have positive effects on internal green practices (b=0.157, P<0.05), while the effect of cost drivers on external green practices is insignificant. These findings further support H1a, H1b and H2b. For the group of large firms, customer drivers have positive effects on external green practices (b=0.359, P<0.001) and internal green practices (b=0.301, P<0.01). Cost drivers also have positive effects on external green practices (b=0.357, P<0.001) and internal green practices (b=0.444, P<0.001). These findings provide support for H1a, H1b, H2a and H2b. Additionally, our results show that at the 10% level of probability of error, the effects of customer drivers on external green practices (△=0.167, P=0.058) and internal green practices (△=0.181, P=0.067) are significantly larger in the small firm group than in the large firm group, supporting H5a and H5b. At the 5% level, the effects of cost drivers on external green practices (△=0.218, P=0.036) and internal green practices (△=0.287, P=0.002) are significantly larger in the large firm group than in the small firm group. This result provides support for H6a and H6b.

<<<<<<Insert Figure 3 and Table 5 about here>>>>>

6. Discussion and implications

Overall, this study verified the model linking cost drivers and customer drivers, GSCM, and environmental performance. The standardized path coefficients show that customer drivers play a more important role in enabling GSCM than cost drivers, which is consistent with the findings in existing literature that customer pressure is the major factor influencing companies' green decisions (Kuei et al., 2015; Walker et al., 2008; Zhang and Yang, 2016). We also confirmed the significant role of cost drivers of GSCM in the presence of customer pressure. This finding indicates that operational factors cannot be neglected in GSCM, consistent with the argument in the supply chain management literature (Govindan et al., 2014; Sarkis et al., 2011). This paper's first contribution to the literature is the empirical validation of the role of internal and external drivers of GSCM.

Our second contribution is that we introduce firm size as moderator of the proposed model. Our comparative analyses show that the effects of cost and customer drivers on GSCM practices are significantly different in small firms from in large firms, empirically extending the previous research suggesting that firm size matters in undertaking sustainable practices (Bourlakis et al., 2014; de Guimarães et al., 2018; Govindan et al., 2015; Zhu et al., 2008b). Consistent with our expectations, small and large firms differ concerning the effects of cost drivers on internal and external green practices. Cost drivers have a significantly lower impact on internal and external green practices in small firms than in large firms. Compared with small firms, the average overhead cost is lower for larger firms, and the cost savings from green practices are more significant for large firms (Baumann-Pauly et al., 2013). In addition, large firms might be more sensitive to the risk of hidden costs caused by the reputation damage as a result of polluting the environment. Interestingly, the impact of cost drivers on external green practices is not significant, which may be because large firms have more resources than small firms. Relative to small firms, large firms have more power to influence suppliers in supply chain collaboration because large firms account for a large portion of their suppliers' product sales. It may not be easy for small firms to persuade their suppliers to participate in green practices, as suggested by the stakeholder theory in GSCM (De Brito et al., 2008). In addition, small firms cannot invest as many financial, physical, or human resources in external green collaboration as large firms can (Govindan et al., 2015; Lee and Klassen, 2008).

Concerning the impact of customer drivers on internal and external green practices, it seems that there are stronger impacts in the small firm group. However, according to the cross-group comparisons, the difference is only marginally significant, which indicates that customer pressure is truly applicable for the green decisions of less powerful firms. However, large firms usually have a formalized structure, clearer strategic goals, and more resources, which may be quite useful in transforming green decisions into practices (Min and Galle, 2001). It is also interesting to find that the impact of external green practices is significant for the large firm group and insignificant for the small firm group, which corroborates the findings that large and small firms facilitate external collaboration differently.

The managerial implications of these findings on the roles of customer and cost drivers of GSCM are significant for companies. First, managers in charge of green activities should consider both internal and external factors when making GSCM decisions. By responding to internal and external pressures differently, manufacturers improve environmental performance when decisions are made based on the resources that they own and spend. Second, it is important that managers make decisions regarding GSCM practice implementation by investing first in either internal green practices or external green practices in order to respond internal and external stakeholders. Third, our findings could help managers understand the role of GSCM in improving environmental performance. The subsample analyses enrich our understanding of this topic and provide practical guidance for managers to follow.

7. Conclusions and future directions

This study shows that customer and cost drivers influence internal and external green practices and, ultimately, environmental performance. Cost drivers have proven to have a significantly lower impact on the internal and external green practices of small firms than on those of large firms. This difference is marginally significant, even though it seems that customer drivers have a stronger impact on the internal and external green practices of small firms than on those of large firms. These findings extend our understanding of the theories and practices discussed in the GSCM literature.

Although this study makes significant contributions to GSCM literature and has important practical implications for companies, it still has several limitations. First, the survey is an international survey that can be generalized. However, the nature of the study may also introduce confounding effects across countries. Future studies may test our model in single countries and identify the potential country-specific factors that may influence the results. Second, this study uses a cross-sectional design to investigate the relationship between drivers, GSCM, and environmental performance.

Although our model is based on the literature, a longitudinal experimental design may be useful in identifying the decision process related to green practices. It is interesting to separate the process and understand the different drivers of green decisions and green implementation. Finally, the findings will be more fruitful if more granular concepts of GSCM are explored. A specific area that needs further investigations is the impacts of drivers of GSCM classified according to social, environmental, and economic perspectives.

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References

Abbasi, M., Nilsson, F., 2012. Themes and challenges in making supply chains environmentally sustainable. Supply Chain Management: An international Journal 17, 517-530.

Agan, Y., Acar, M.F., Borodin, A., 2013. Drivers of environmental processes and their impact on performance: a study of Turkish SMEs. J Clean Prod 51, 23-33.

Agi, M.A., Nishant, R., 2017. Understanding influential factors on implementing green supply chain management practices: An interpretive structural modelling analysis. J Environ Manage 188, 351-363.

Ahi, P., Searcy, C., 2013. A comparative literature analysis of definitions for green and sustainable supply chain management. J Clean Prod 52, 329-341.

Ang, A., 2007. China Toy Boss Kills Himself Amid Recall, The Washington Post. The Associated Press

Arend, R.J., 2014. Social and environmental performance at SMEs: Considering motivations, capabilities, and instrumentalism. Journal of Business Ethics 125, 541-561.

Baumann-Pauly, D., Wickert, C., Spence, L.J., Scherer, A.G., 2013. Organizing corporate social responsibility in small and large firms: size matters. Journal of Business Ethics 115, 693-705.

Bose, I., Pal, R., 2012. Do green supply chain management initiatives impact stock prices of firms? Decision Support Systems 52, 624-634.

Bourlakis, M., Maglaras, G., Aktas, E., Gallear, D., Fotopoulos, C., 2014. Firm size and sustainable performance in food supply chains: Insights from Greek SMEs. International Journal of Production Economics 152, 112-130.

Carter, C.R., Dresner, M., 2001. Purchasing's role in environmental management: cross-functional development of grounded theory. Journal of Supply Chain Management 37, 12-27.

Carter, C.R., Jennings, M.M., 2004. The role of purchasing in corporate social responsibility: a structural equation analysis. Journal of Business Logistics 25, 145-186.

Carter, C.R., Rogers, D.S., 2008. A framework of sustainable supply chain management: moving toward new theory. International Journal of Physical Distribution & Logistics Management 38, 360-387.

Craighead, C.W., Ketchen, D.J., Dunn, K.S., Hult, G.T.M., 2011. Addressing common method variance: guidelines for survey research on information technology, operations, and supply chain management. IEEE Transactions on Engineering Management 58, 578-588.

Cucchiella, F., Koh, L., Walker, H., Jones, N., 2012. Sustainable supply chain management across the UK private sector. Supply Chain Management: An international Journal 17, 15-28.

Dües, C.M., Tan, K.H., Lim, M., 2013. Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain. J Clean Prod 40, 93-100.

De Brito, M.P., Carbone, V., Blanquart, C.M., 2008. Towards a sustainable fashion retail supply chain in Europe: Organisation and performance. International Journal of Production Economics 114, 534-553.

de Guimarães, J.C.F., Severo, E.A., de Vasconcelos, C.R.M., 2018. The influence of entrepreneurial, market, knowledge management orientations on cleaner production and the sustainable competitive advantage. J Clean Prod 174, 1653-1663.

Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18, 29-50.

Ghadimi, P., Azadnia, A.H., Heavey, C., Dolgui, A., Can, B., 2015. A review on the buyer–supplier dyad relationships in sustainable procurement context: past, present and future. International Journal of Production Research, 1-20.

Gosling, J., Jia, F., Gong, Y., Brown, S., 2017. The role of supply chain leadership in the learning of sustainable practice: toward an integrated framework. J Clean Prod 140, 239-250.

Govindan, K., Azevedo, S.G., Carvalho, H., Cruz-Machado, V., 2014. Impact of supply chain management practices on sustainability. J Clean Prod 85, 212-225.

Govindan, K., Diabat, A., Shankar, K.M., 2015. Analyzing the drivers of green manufacturing with fuzzy approach. J Clean Prod 96, 182-193.

Hair, J.F., Ringle, C.M., Sarstedt, M., 2013. Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. Long Range Planning 46, forthcoming (online available).

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, 293-315.

Henseler, J., Dijkstra, T., Sarstedt, M., Ringle, C., Diamantopoulos, A., Straub, D., Ketchen, D., Hair, J.F., Hult, G., Calantone, R., 2014. Common beliefs and reality about partial least squares: Comments on Rönkkö and Evermann. Organizational Research Methods 17, 182-209.

Henseler, J., Ringle, C.M., Sinkovics, R.R., 2009. The Use of Partial Least Squares Path Modeling in International Marketing, in: Sinkovics, R.R., Ghauri, P.N. (Eds.), Advances in International Marketing. Emerald Bingley, pp. 277-320.

Holt, D., Ghobadian, A., 2009. An empirical study of green supply chain management practices amongst UK manufacturers. Journal of Manufacturing Technology Management 20, 933-956.

Jayaram, J., Avittathur, B., 2015. Green supply chains: A perspective from an emerging economy. International Journal of Production Economics 164, 234-244.
Koufteros, X.A., Cheng, T.C.E., Lai, K., 2007. 'Black-box' and 'gray-box' supplier integration in product development: Antecedents, consequences and the moderating role of firm size. Journal of Operations Management 25, 847-870.
Kuei, C.-h., Madu, C.N., Chow, W.S., Chen, Y., 2015. Determinants and associated performance improvement of green supply chain management in China. J Clean Prod 95, 163-173.
Lee, S.Y., Klassen, R.D., 2008. Drivers and enablers that foster environmental management capabilities in small-and medium-sized suppliers in supply chains. Production and Operations Management 17, 573-586.
Leonidou, L.C., Christodoulides, P., Thwaites, D., 2016. External Determinants and Financial Outcomes of an Eco-friendly Orientation in Smaller Manufacturing Firms. Journal of Small Business Management 54, 5-25.
Lin, C.-Y., Ho, Y.-H., 2011. Determinants of green practice adoption for logistics companies in China. Journal of Business Ethics 98, 67-83.
Lo, S.M., Shiah, Y.-A., 2016. Associating the motivation with the practices of firms going green: the moderator role of environmental uncertainty. Supply Chain Management: An international Journal 21, 485-498.
London, T., Hart, S.L., 2004. Reinventing strategies for emerging markets: beyond the transnational model. Journal of International Business Studies 35, 350-370.
McFarland, R.G., Bloodgood, J.M., Payan, J.M., 2008. Supply chain contagion. Journal of Marketing 72, 63-79.
Melnyk, S.A., Sroufe, R.P., Calantone, R., 2003. Assessing the impact of environmental management systems on corporate and environmental performance. Journal of Operations Management 21, 329-351.
Min, H., Galle, W.P., 1997. Green purchasing strategies: trends and implications. Journal of Supply Chain Management 33, 10.
Min, H., Galle, W.P., 2001. Green purchasing practices of US firms. International Journal of Operations & Production Management 21, 1222-1238.
Mishra, A.A., Shah, R., 2009. In union lies strength: Collaborative competence in new product development and its performance effects. Journal of Operations Management 27, 324-338.
Mitra, S., Datta, P.P., 2014. Adoption of green supply chain management practices and their impact on performance: an exploratory study of Indian manufacturing firms. International Journal of Production Research 52, 2085-2107.
Moch, M.K., Morse, E.V., 1977. Size, centralization and organizational adoption of innovations. American Sociological Review 42, 716-725.
Mollenkopf, D., Stolze, H., Tate, W.L., Ueltschy, M., 2010. Green, lean, and global supply chains. International Journal of Physical Distribution & Logistics Management 40, 14-41.
Motohashi, K., 2015. Comparison of Economic Institutions in China and India, Global Business Strategy: Multinational Corporations Venturing into Emerging Markets. Springer, pp. 57-76.
Mullen, M.R., 1995. Diagnosing measurement equivalence in cross-national research. Journal of International Business Studies 26, 573-596.
Naor, M., Linderman, K., Schroeder, R., 2010. The globalization of operations in Eastern and Western countries: Unpacking the relationship between national and organizational culture and its impact on manufacturing performance. Journal of Operations Management 28, 194-205.

Nunnally, J.C., Bernstein, I.H., 1994. Psychometric theory, third ed. McGraw-HIll, New York.
Pavlou, P.A., Liang, H., Xue, Y., 2007. Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. MIS Quarterly 31, 105-136.
Peng, D.X., Lai, F., 2012. Using partial least squares in operations management research: A practical guideline and summary of past research. Journal of Operations Management 30, 467-480.
Pfeffer, J., Salancik, G.R., 2007. The External Control of Organization: A Resource Dependence Perspective. Harper & Row, New York.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88, 879-903.
Ringle, C.M., Wende, S., Becker, J.-M., 2015. SmartPLS 3. www.smartpls.de.
Rueda, X., Garrett, R.D., Lambin, E.F., 2017. Corporate investments in supply chain sustainability: Selecting instruments in the agri-food industry. J Clean Prod 142, 2480-2492.
Sarkis, J., Zhu, Q., Lai, K.-h., 2011. An organizational theoretic review of green supply chain management literature. International Journal of Production Economics 130, 1-15.
Sharma, S., Vredenburg, H., 1998. Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. Strategic Management Journal 19, 729-753.
Somsuk, N., Laosirihongthong, T., 2017. Prioritization of applicable drivers for green supply chain management implementation toward sustainability in Thailand. International Journal of Sustainable Development & World Ecology 24, 175-191.
Subramanian, N., Gunasekaran, A., 2015. Cleaner supply-chain management practices for twenty-first-century organizational competitiveness: Practice-performance framework and research propositions. International Journal of Production Economics 164, 216-233.
Tachizawa, E.M., Gimenez, C., Sierra, V., 2015. Green supply chain management approaches: drivers and performance implications. International Journal of Operations & Production Management 35, 1546-1566.
Tilley, F., 1999. The gap between the environmental attitudes and the environmental behaviour of small firms. Business Strategy and the Environment 8, 238-248.
Tranfield, D., Denyer, D., Smart, P., 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British Journal of Management 14, 207-222.
Vanalle, R.M., Ganga, G.M.D., Godinho Filho, M., Lucato, W.C., 2017. Green supply chain management: An investigation of pressures, practices, and performance within the Brazilian automotive supply chain. J Clean Prod 151, 250-259.
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, 69-85.
Walker, K., Ni, N., Huo, W., 2014. Is the red dragon green? An examination of the antecedents and consequences of environmental proactivity in China. Journal of business ethics 125, 27-43.
Wang, Z., Chen, L., Zhao, X., Zhou, W., 2014. Modularity in building mass customization capability: The mediating effects of customization knowledge utilization and business process improvement. Technovation 34, 678-687.
Wetzels, M., Odekerken-Schröder, G., Van Oppen, C., 2009. Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. MIS Quarterly 33, 177-195.
Wilhelm, M., Blome, C., Wieck, E., Xiao, C.Y., 2016. Implementing sustainability in multi-tier supply

chains: Strategies and contingencies in managing sub-suppliers. International Journal of Production Economics 182, 196-212.
Yang, C.-S., Lu, C.-S., Haider, J.J., Marlow, P.B., 2013. The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. Transportation Research Part E: Logistics and Transportation Review 55, 55-73.
Yu, W., Ramanathan, R., 2015. An empirical examination of stakeholder pressures, green operations practices and environmental performance. International Journal of Production Research 53, 6390-6407.
Zeng, H., Chen, X., Xiao, X., Zhou, Z., 2017. Institutional pressures, sustainable supply chain management, and circular economy capability: Empirical evidence from Chinese eco-industrial park firms. J Clean Prod 155, 54-65.
Zhang, H., Yang, F., 2016. On the drivers and performance outcomes of green practices adoption: An empirical study in China. Industrial Management & Data Systems 116, 2011-2034.
Zhu, Q., 2016. Institutional pressures and support from industrial zones for motivating sustainable production among Chinese manufacturers. International Journal of Production Economics 181, 402-409.
Zhu, Q., Qu, Y., Geng, Y., Fujita, T., 2017. A comparison of regulatory awareness and green supply chain management practices among Chinese and Japanese manufacturers. Business strategy and the environment 26, 18-30.
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, 265-289.
Zhu, Q., Sarkis, J., 2006. An inter-sectoral comparison of green supply chain management in China: drivers and practices. J Clean Prod 14, 472-486.
Zhu, Q., Sarkis, J., Lai, K.-h., 2007. Green supply chain management: pressures, practices and performance within the Chinese automobile industry. J Clean Prod 15, 1041-1052.
Zhu, Q., Sarkis, J., Lai, K.-h., 2008a. Green supply chain management implications for “closing the loop”. Transportation Research Part E: Logistics and Transportation Review 44, 1-18.
Zhu, Q., Sarkis, J., Lai, K.-h., 2012. Examining the effects of green supply chain management practices and their mediations on performance improvements. International Journal of Production Research 50, 1377-1394.
Zhu, Q., Sarkis, J., Lai, K.-h., 2013. Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. Journal of purchasing and supply management 19, 106-117.
Zhu, Q., Sarkis, J., Lai, K.h., Geng, Y., 2008b. The role of organizational size in the adoption of green supply chain management practices in China. Corporate Social Responsibility and Environmental Management 15, 322-337.

Appendix A: Summary of the recent literature on the drivers of GSCM practices

References	Drivers	GSCM dimensions	Contingent factors
Agi and Nishant (2017)	Non-market pressures Market pressures Voluntary proactive strategy	GSCM practices	
de Guimarães et al. (2018)	Strategic drivers (entrepreneurial orientation, market orientation and knowledge management orientation)	Cleaner production	Activity sector Company size
Govindan et al. (2015)	Twelve drivers (financial benefits, stakeholders, customers, competitors, etc.)	Green manufacturing	
Kuei et al. (2015)	Technological factors Organizational factors Environmental factors	Green practices	
Lo and Shiah (2016)	External drivers Internal drivers	GSCM practices (green purchasing, green design & manufacturing, green logistics, internal management)	Environmental uncertainty (demand, competition, supply)
Tachizawa et al. (2015)	Internal drivers (top management) External drivers (mimetic, coercive, normative)	Monitoring Collaboration	
Vanalle et al. (2017)	Institutional pressures	Internal GSCM practices External GSCM practices	
Zeng et al. (2017)	Institutional pressure	Sustainable supply chain design	Institutional pressure
Zhang and Yang (2016)	Internal stakeholders External stakeholders	Green practices	
Zhu (2016)	Institutional pressures Support from industrial zones	Sustainable production practices	

Table 1: Firm profiles

Country	Num.	Percentage	Industry	Num.	Percentage
Brazil	15	6.1	Machine	83	33.7
Germany	23	9.3	Electrics	94	38.2
Spain	21	8.5	Transport equipment	69	28.0
Israel	10	4.1	Total	246	100.0
Finland & Sweden	24	9.8			
Italy	26	10.6			
Japan	19	7.7			
Mainland China	23	9.3			
South Korea	25	10.2			
Taiwan	23	9.3			
United Kingdom	13	5.3			
Vietnam	24	9.8			
Total	246	100.0			

Table 2: Factor loadings of scale items for each group (CFA factor loadings)

Measurement	Loading		
	All	Small	Large
Customer drivers			
My plant's involvement in environmental initiatives has been motivated by (1=No extent whatsoever, 5= Very great extent)			
Programs that our customers have in place	0.871	0.886	0.849
Customers who seek environmentally responsible suppliers	0.920	0.918	0.921
Increased awareness of environmental issues among our customers	0.948	0.951	0.944
Customers who believe that environmental protection is important	0.932	0.937	0.921
Cost drivers			
My plant's involvement in environmental initiatives has been motivated by (1=No extent whatsoever, 5= Very great extent)			
The belief that we could reduce costs and help the environment at the same time	0.831	0.837	0.829
The desire to be more cost competitive	0.870	0.855	0.880
The need to reduce costs	0.886	0.878	0.895
The desire for cost savings	0.856	0.850	0.864
External green practices *Please indicate the degree to which your plant is engaged in the following initiatives/practices: (1=No extent whatsoever, 5= Very great extent)*			
Encouraging suppliers to improve the environmental performance of their processes	0.875	0.893	0.811
Incorporating environmental considerations in evaluating and selecting suppliers	0.795	0.819	0.696
Providing design specification to suppliers in line with environmental requirements (e.g., green purchasing, black list of raw materials)	0.770	0.740	0.802
Co-development with suppliers to reduce the environmental impact of	0.833	0.846	0.785

the product (e.g., eco-design, green packaging, recyclability)			
Involvement of suppliers in the re-design of internal processes (e.g., remanufacturing, reduction of by-products)	0.845	0.860	0.821
Internal green practices *Please indicate the degree to which your plant is engaged in the following initiatives/practices: (1=No extent whatsoever, 5= Very great extent)*			
Reducing waste in internal processes (e.g., improving yield or efficiency)	0.829	0.864	0.769
Life-cycle analysis of the "cradle to grave" environmental impact of materials/products	0.813	0.807	0.798
Environmental improvements in the disposition of your organization's scrap or excess material (re-use, recycling, etc.)	0.733	0.692	0.768
Environmental improvements in the disposition of your organization's equipment	0.799	0.818	0.735
Environmental performance *How does your plant compare to others in your global industry on (1=Much worse, 5= Much better)*			
Raw materials consumption	0.841	0.839	0.834
Energy consumption	0.888	0.885	0.885
Water consumption	0.863	0.855	0.866
Emissions to water	0.818	0.822	0.808
Releases to water	0.749	0.720	0.800
Solid waste generation (e.g., landfill capacity consumed)	0.774	0.727	0.842

Table 3: Reliability and convergent validity

Group	Variables	Cronbach's alpha	C.R.	AVE
All N=246	Customer drivers	0.938	0.955	0.843
	Cost drivers	0.891	0.920	0.742
	External green practices	0.881	0.914	0.679
	Internal green practices	0.806	0.872	0.631
	Environmental performance	0.906	0.926	0.678
Small N=148	Customer drivers	0.942	0.958	0.852
	Cost drivers	0.888	0.916	0.731
	External green practices	0.889	0.919	0.694
	Internal green practices	0.810	0.874	0.637
	Environmental performance	0.896	0.919	0.657
Large N=98	Customer drivers	0.931	0.950	0.827
	Cost drivers	0.895	0.924	0.752
	External green practices	0.843	0.888	0.615
	Internal green practices	0.768	0.852	0.589
	Environmental performance	0.917	0.935	0.705

Table 4: Correlation and discriminant validity

Group	Variables	1	2	3	4	5
	Customer drivers (1)	0.918				
	Cost drivers (2)	0.341	0.861			
All	External green practices (3)	0.543	0.380	0.824		
N=246	Internal green practices (4)	0.500	0.403	0.738	0.795	
	Environmental performance (5)	0.393	0.500	0.457	0.448	0.824
Small	Customer drivers (1)	**0.923**				
N=148	Cost drivers (2)	0.362	**0.855**			
	External green practices (3)	0.576	0.329	**0.833**		
	Internal green practices (4)	0.539	0.331	0.752	**0.798**	
	Environmental performance (5)	0.487	0.461	0.429	0.458	**0.810**
Large	Customer drivers (1)	**0.910**				
N=98	Cost drivers (2)	0.284	**0.867**			
	External green practices (3)	0.460	0.459	**0.784**		
	Internal green practices (4)	0.427	0.530	0.654	**0.768**	
	Environmental performance (5)	0.222	0.543	0.489	0.417	**0.840**

Table 5: Statistical comparison of path coefficients between small and large enterprises

	Small firms		Large firms		Small vs. large (PLS-MGA)	
	Path coefficient	SE	Path coefficient	SE	ABS (difference)	P-value
Customer drivers → External green practices	**0.526*** **	**0.071**	**0.359*** **	**0.080**	**0.167+**	**0.058**
Customer drivers → Internal green practices	**0.482*** **	**0.072**	**0.301** **	**0.098**	**0.181+**	**0.067**
Cost drivers → External green practices	**0.138**	**0.087**	**0.357*** **	**0.085**	**0.218* **	**0.036**
Cost drivers → Internal green practices	**0.157* **	**0.067**	**0.444*** **	**0.073**	**0.287** **	**0.002**
External green practices → Environmental performance	0.170	0.117	0.306*	0.135	0.136	0.782
Internal green practices → Environmental performance	0.318**	0.108	0.210+	0.119	0.108	0.249

+ p<0.1; * p<0.05, ** p<0.01, *** p<0.001

Bold text signifies the significantly different path between two groups.

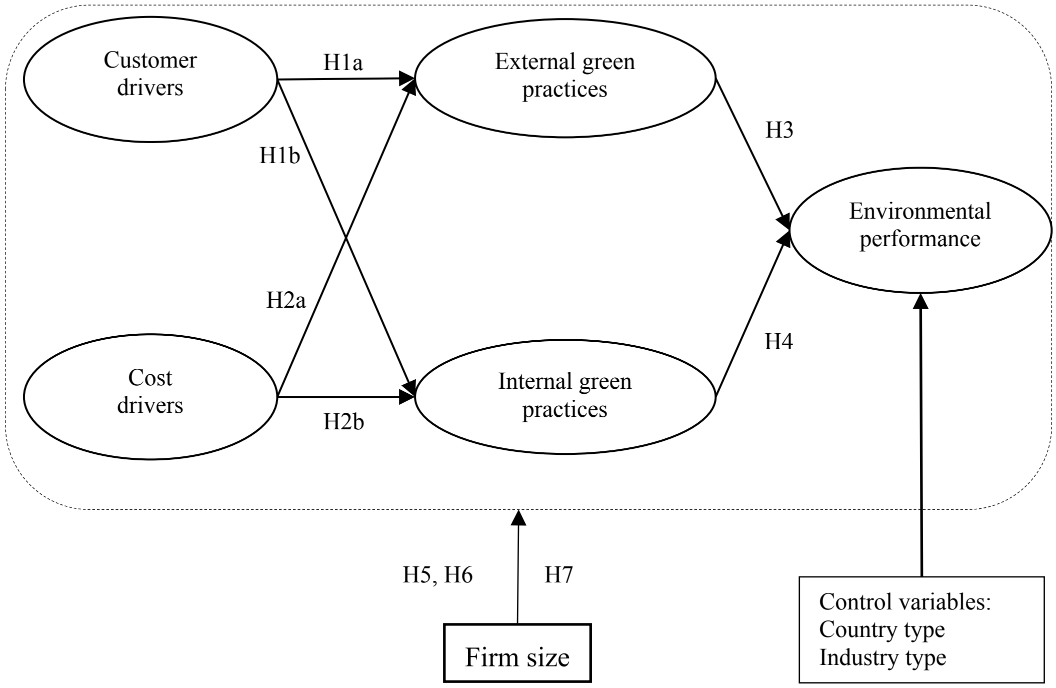
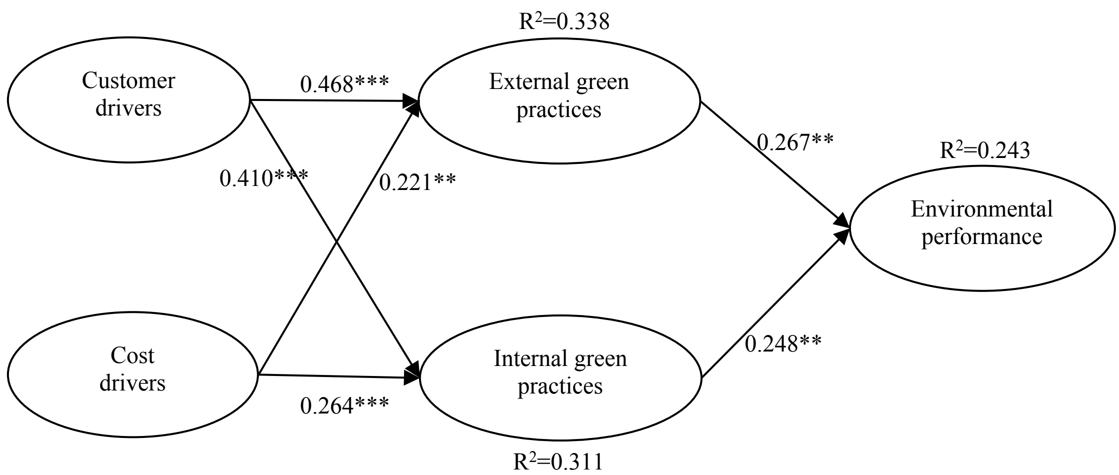
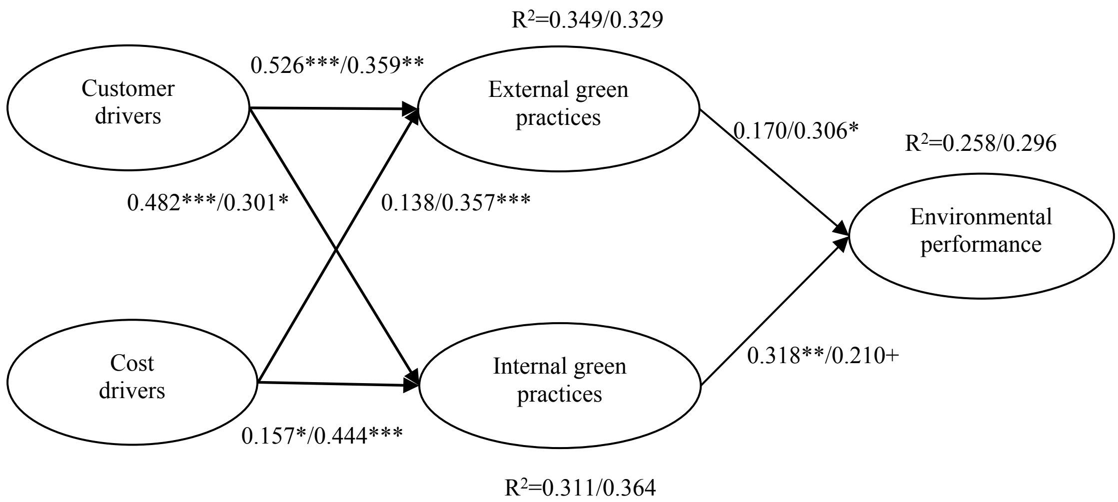


Figure 1: Conceptual model



+, p<0.1; *, p<0.05; **, p<0.01; ***, p<0.001

Figure 2: Structural model with parameter estimates (whole dataset)



Small/large； +, p<0.1; *, p<0.05; **, p<0.01; ***, p<0.001

Figure 3: The moderating effects of firm size

The effects of customer and cost drivers on green supply chain management (GSCM) practices have been investigated.

Internal and external green practices positively influence environmental performance.

The size of the firm moderates the relationships between customer/cost drivers and GSCM practices.

The proposed relationships are tested in an international survey.