The impact of internal and external green supply chain management activities on performance improvement: evidence from the automobile industry

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ABSTRACT

Although the significance of green supply chain management activities on corporation sustainable development has been highlighted in the literature, the potential inter-dependencies between these activities and corporation performance have not been investigated by considering cooperation moderation. The purpose of this research is to examine internal and external Green Supply Chain Management (GSCM) activity on automobile performance: Environmental performance, operational performance, positive economic performance, and negative economic performance. Using survey data from foreign-owned company A with 117 manufacturing firms and domestic company B with 94 manufacturing firms, a significant relationship between GSCM and corporation performance has been found. For foreign-owned automobile companies, internal organizational activity has the greatest influence on operational performance, and promotes corporate value and corporation with outside. However, for domestic automobile companies with the advanced green concept, Eco-design exerts the biggest effect on environmental performance, and also brought a negative economic impact on corporate performance. Moreover, although both corporate social responsibility (CSR) and creating shared value (CSV) promotion could influence the corporation with consumers and suppliers, CSV promotion has a more positive influence on cooperation with consumers than that CSR. These findings have important implications for designing GSCM strategic plans for the automotive industry in developing countries.

1. Introduction

The arrival of the information era has brought tremendous changes in the management model of enterprises in recent years. The direct competition among enterprises has gradually been replaced by integrating different supply chain management activities (Gonzalez et al., 2008; Lee, 2011). However, from the perspective of development, enterprises mainly pursue the maximization of economic benefits in the process of supply chain management, while ignoring the environmental impact caused by production and operation activities (Zhu et al., 2020). Especially in China, this restricts the rationalization process of supply chain management, and also causes the enterprise to face “green barriers” in international competition. Therefore, taking environmental protection into account in the entire supply chain management process, and strengthening the unity of economic and environmental performance has become the consensus in practices.

Currently, many companies place environmental objectives on their agenda and engage in Green Supply Chain Management (GSCM) activities, including internal organizational activities, Eco-design, cooperation promotion, recycling, and re-manufacturing, etc. These factors are key contributors to competitiveness but do not always create actual economic benefits or environmental benefits in the short terms. Although some studies exist in the literature to measure the impacts of GSCM practices on corporate business performance (Azevedo et al., 2011; Olugu et al., 2011; Mathiyazhagan and Haq, 2013; Grimm et al., 2014; Mitra and Datta, 2014; Govindan et al., 2016). These mixed findings suggest the uncertainty in linking the above constructs and may be due to differences in the modeled relationships, the characteristics of different enterprises,
and business performance. Besides, the use of environmental management measures within the existing company itself still has certain limitations (Zhu et al., 2019). For example, literature pointed out that even if advanced environmental management methods have been introduced within the company, in the case of the upper-level suppliers implementing production activities that damage the global environment, there are still existing punishments for enterprises as a provider of products (Green et al., 2012). Hence, environmental management based on the supply chain units of suppliers and customers with business relationships is the key to solving the global warming effect. More and more enterprise has started to integrate internal and external GSCM activities into a set of GSCM practice. However, the potential inter-dependency of different GSCM practices has been largely ignored in the literature (Claver et al., 2007).

Many scholars have studied the corporate performance changes brought by green supply chain management practices to enterprises from various perspectives. Some literature believed that the implementation of green supply chain management would firstly improve the environmental performance of enterprises, and then promote the positive economic performance of enterprises (Cherifi et al., 2017; Geng et al., 2017; Hong et al., 2018). At the same time, it will increase the operating cost of procurement, etc., resulting in negative economic performance. However, these findings might not apply to other types of business, which has been confirmed in the literature. The core debate among these studies is mainly concentrated on the following two aspects: first, there is debate on the independence (substitutability) or dependence (complementarity) of GSCM practices and their impact on performance. Both independent, mediated, and contingent can be found in the literature. Second, the interaction of different performances has no clearly identified in GSCM practices. Most existing literature focuses on the effect of GSCM practices on environmental performance (Dubey et al., 2015; Mirhedayatian et al., 2014; Tuzkaya et al., 2009) and economic performance (Rao and Holt, 2005; Zhu et al., 2012a). Less literature pays attention to the impact of operational performance on environmental and economic performance. To our knowledge, no attempt has been made to study the interdependence of internal and external GSCM practices and different performances from a comprehensive perspective. The main objective of this article is to examine the interaction impact of internal and external GSCM practices on different performances including environmental performance, operational performance, positive economic performance, and negative economic performance.

To solve this research gap, this paper takes foreign-owned company A and domestic automobile company B as examples to support a more generalized conclusion about the relationship between GSCM practices and business performance. These two enterprises have representative of the aspects of the production system, green supply chain management, and innovation perspectives in the automobile industry. This paper had the opportunity to access foreign-owned company A and domestic company B with 117 and 94 manufacturing firms respectively, fully supported by the Ministry of Commerce and Industry. The comparison of research findings from foreign-owned company A and domestic company B could provide a strong reference value for enterprises and governments in practical GSCM management.

By empirical analysis, we would like to answer the following questions: (1) what is the interdependent relationship between internal and external GSCM practices and their impact on different performances? (2) how does cooperation with customers and suppliers moderate the relationship between GSCM practices and business performance? (3) what is the difference between GSCM practices’ impact on business performance among different enterprises?

The paper is organized as follows: In Section 2, This paper proposes the conceptual framework and hypothesis with literature support. Section 3 discusses the research survey and method. Data analysis and the results are shown in Section 4, and discussions are presented in Section 5. In Section 6, This paper concludes the research and addresses the research limitations.

2. Model conceptualization and hypothesis development

GSCM is a popular concept among manufacturers and suppliers to improve the greenness and economic performance of enterprises while achieving sustainable development of enterprises. It focused on product design, raw material acquisition, product manufacturing, packaging, warehousing, transportation, use and recycling through cooperation with upstream and downstream companies and communication between various departments within the company (Klassen and Whybark, 1999). This paper adopts a comprehensive definition of GSCM and considers both internal and external initiatives in our conceptual model (As shown in Figure 1).

2.1. The interdependent impact of internal GSCM practices

Internal GSCM practices including dedication and support from managers may be necessary for GSCM practices implementation. Internal management is one of the key factors for business organizations to implement GSCM practices. Previous research on GSCM practices mainly focuses on organizational system & management technology from various aspects such as internal organizational activities, Eco-design, and promotion of corporate social responsibility (CSR) (Moktadir et al., 2018; Zhang et al., 2017; Govindan et al., 2014; Lai and Wong, 2012; Walker and Jones, 2012; Zhu et al., 2012b; Diabat and Govindan, 2011; Dai et al., 2021). These measures are the environmental management items related to the low-carbon development strategy in firms, and this research also considers them as the research objects. Also, this paper introduces the promotion of creating shared value (CSV) into our research as the main aspect of corporate value promotion in GSCM practices. CSV is a popular concept represented to enable enterprises to solve social or environmental issues in their work and create co-value including corporate value, environmental value, and social value (Yoo and Kim, 2019).

Compared with CSR, CSV shows the clear goal of obtaining corporate benefits while solving social problems such as the environment simultaneously. The promotion of CSR and CSV is based on internal GSCM practices such as organizational activities and Eco-design. For example, one of the CSV practices can be cited as an aspect of the supply of environmentally friendly products, this can only be achieved based on Eco-design. Also, the environmental report in CSR management was always produced based on Eco-design. Besides, the promotion of CSR and CSV is difficult to advance without the support from the organizational system and management technology in the enterprise (Pedersen et al., 2018; Yoo and Kim, 2019). Therefore, the following hypothesis is developed:

H1. Initial GSCM practices (organizational activities and Eco-design) have a positive effect on the CSR and CSV promotion and incorporation value promotion.

2.2. The impact of internal GSCM on external GSCM practices

The external GSCM practices aim to identify and reduce the environmental impacts throughout the supply chain by promoting the corporation’s internal operations (Vachon and Klassen, 2006). Automobile companies would take environmental performance into account in supplier selection criteria and request suppliers to develop environmental management capabilities (Darnall and Edwards, 2006). Besides, environmental management would be promoted by cooperating with customers to reduce the environmental load in GSCM practices. More and more firms have realized the importance of cooperation with suppliers and customers, and reducing the environmental and economic risks throughout the Eco-designed product's process.

Both internal and external collaboration play an influential role in greening the supply chain (Kumar et al., 2013). Developing countries like China have been experiencing heavy pressure to implement green GSCM.
practices in the supply chain to meet customers’ increasing needs in the market (Xu et al., 2013). The implementation of GSCM which adopts the cooperation with customers and suppliers has been promoted by internal GSCM practices within the enterprise, which has also been verified in enterprises of China and Italy. Hence, This paper proposes the hypothesis as follows:

**H2.** Internal GSCM practices have a significant promotion on the external GSCM activities (i.e. cooperation with suppliers and customers).

### 2.3. The impact of GSCM practices on business performance

First, the implementation of GSCM practices is based on the premise of improving environmental performance. Effective management of suppliers can encourage recycling, reuse, and re-manufacturing activities, which would help to improve their environmental performance. Frosch (1994) interviewed various departments of nearly 30 companies to identify how to reduce waste generated in the production process. It found that external cooperation with suppliers and customers would enhance environmental performance. Stevels and Ieee (2002) pointed out that cooperation between supply chain partners in the field of Eco-design and manufacturing can generate enormous ecological benefits. Gotschol et al. (2014) demonstrated empirical evidence that cooperation with suppliers can help improve the environmental performance of Italian manufacturing.

Second, the implementation of GSCM will enable enterprises to obtain economic benefits by reducing sewage costs and environmental risks to increase market share and customer satisfaction. This kind of economic benefit is called positive economic performance. For example, Zhu et al. (2017) demonstrate that GSCM practices have had a positive impact on a company’s economic performance. However, the implementation of GSCM practices will inevitably require a large number of financial and material inputs, such as the cost of purchasing green materials, operating and training costs, etc. These increases in economic costs are negative for companies and are therefore defined as negative economic performance (Khan and Dong, 2017). demonstrated that GSCM implementations like an environmental design for Chinese companies are influenced by negative economic performance.

Third, operational performances have been identified in the supply chain in the literature. GSCM initiatives will help to improve product quality and process performance, delivery, and flexibility (Chauhan and Singh, 2018; Inman and Green, 2018). Previous literature shows that external GSCM practices exert a positive influence on operational performance which is reflected in the reduction of waste, improvement in product delivery capacity, and improvement in capacity utilization and production efficiency (Famiyeh et al., 2018). Also, external cooperation with suppliers or customers in GSCM practices would promote the improvement of operational performance. Hence, the following hypothesis is developed:

**H3.** Internal GSCM practices have a positive impact on business performance (i.e. positive/negative economic performance; environmental performance; operational performance).

**H4.** External GSCM exerts a positive impact on the business performance (i.e. positive/negative economic performance; environmental performance; operational performance).

### 3. Data and research method

#### 3.1. Data collection and the sample

This paper used a questionnaire survey method to measure the impacts of GSCM practices toward sustainability on business performance in China’s automobile sector. The survey was conducted in 117 manufacturing firms of company A and 94 manufacturing firms of company B, which are representative of GSCM practices among foreign-owned and domestic firms in China. Company A highlighted lean production and just-in-time as important innovations to achieve optimization throughout the supply chain. And it formed the latest “company A Green Procurement Guidelines” in 2016, which requires automobile suppliers to take active measures in the GSCM practices. However, company B as a domestic automobile manufacturer still face the question of how to balance the environmental performance and economic performance, which reflect the GSCM implementation status in domestic automobile enterprise in China. Company B does not currently have a
management system for green supply chains, and enterprises have a strong demand for the green supply chain management. According to Liu et al. (2017), we conducted a cluster sampling survey method to ensure the representativeness of the questionnaire. First, we put these companies into a data pool and divided them into different clusters according to the characteristics of a company. Second, we used the method of random sampling to select the sample from the above clusters. Finally, a total of 117 manufacturing firms of company A and 94 manufacturing firms of company B from the automobile industry were obtained.

The questionnaire was designed after a thorough review of the literature. The questionnaire includes four sections. The first Section A captures the details about the reviewed manufacturing firms. The questions in Section B deal with internal and external GSCM practices from an extensive review. Section C consists of questions related to evaluating the present business performance after GSCM measures were taken. Before the informal investigation, this paper conducts a pilot survey by measuring reliability and validity, and then the contents of the questionnaire are refined. After consultation with experts and a literature review, the final draft of the questionnaire was made with a few modifications.

The survey data were collected from May to October of 2018, with the survey consisting of online random sampling via email and cluster sampling with field survey. This paper collects 832 valid questionnaires with an effective response rate of 67.8%. The participants in the survey are top-level executives in the position of production manager, operation manager, quality manager, and executive director. It is hereby declared that this research has obtained informed consent from all participants.

3.2. Measurement

The GSCM practices were used as a multidimensional construct, which was measured with multiple-item scales. This paper adopted these items from previous literature and modified slightly them to fit the current research context. This paper followed Churchill's (1979) research paradigm to develop measures for influencing factors of intention.

The measurement items of internal GSCM practices include organizational activities and Eco-design adopted from the work (Vanalle et al., 2017; Diabat et al., 2013; Olugu et al., 2011). The internal organizational activities were defined as an effective measure to enhance the environmental awareness of business leaders and employees and make them design the mechanism for operation and assessment to reduce environmental pollution across functional departments. Eco-design means that environmental protection and energy conservation factors are taken into consideration to fundamentally prevent pollution, and save energy and resources in the design stage. In the category of corporate value promotion, the measurement items of CSR and GSV promotion were adopted from the work (Porter and Kramer, 2007). Corporate social responsibility (CSR) requires companies to surpass traditional profit as the sole objective and emphasizes the contribution to the consumers, environment, and society. Creating shared value (GSV) is an emerging concept in GSCM practices, which emphasizes the value must be created by both company and the consumer. The company with GSV promotion would encourage each customer to cooperate with the company, share experiences, create value together, and achieve high-quality interaction and integration forming the core competitiveness of the company.

External GSCM practices have also grown in importance. Green et al. (2012) found that the development of environmentally oriented relationships with suppliers and customers could lead to innovative environmental solutions. The external GSCM practices including cooperation with suppliers and customers were adopted from work (Vanalle et al., 2017). Cooperation with suppliers is one of the most critical aspects of GSCM practices. Suppliers are upstream of the supply chain. Supplier behaviors (i.e. resource conservation, environmental protection, etc.) would directly affect the downstream links with the transmission of the supply chain, which affects the overall greenness of the supply chain and the efficiency of resource utilization. Therefore, enterprises need to choose suppliers with good environmental benefits. Meanwhile, consumers are also increasingly aware of the importance of the environment. More and more consumers show a preference for environmentally responsible companies, which provides good support for green marketing.

GSCM business performance scale is mainly adopted by Sarkis et al. (2011). The items of environmental performance were designed to measure the impact of GSCM practices on the environment and ecology such as wastewater, waste gas, solid waste, toxic chemicals, etc. This paper adopted the items of operational performances from Tippayawong et al. (2016) and Yu et al. (2014), and these items were designed from different aspects of cost, time, quality, flexibility, and innovation. For economic performance research, This paper divided economic performance into positive economic performance and negative economic performance. Positive economic performance would occur when the GSCM strategy improves business performance and competitive advantage to achieve a win-win situation in both environmental and economic performance in long term. The items of positive economic performance were designed to reflect economic benefits from GSCM practices such as raw materials conservation, market share improvement, treatment costs, or fines for environmental accident reduction. However, improvement of environmental management necessarily means an increase in costs, especially in the initial stage. Hence, items of negative economic performance reflect the improvement of procurement costs, training costs, and green investment in GSCM practices. By calculation, the validities and reliabilities of company A Scale and company B Scale are shown in Table 1 and Table 2.

4. Results

4.1. Overview of descriptive results

Figure 2 shows the average score of GSCM implementation for each supplier in company B and company A. The six indicators are internal organizational activity (including 8 items, out of 40 points), Eco-design (including 6 items, out of 30 points), social responsibility awareness (including 5 items, out of 25 points), shared value creation (including 7 three-level indicators, out of 35 points), cooperation with the supplier (including 13 items, out of 65 points) and cooperation with the consumer (including 4 items, out of 20 points). According to Figure 2, company A’s average supplier score is generally higher than the average score of company B’s suppliers. The first-level indicators with larger gaps are internal organizational activity, cooperation with the supplier, and shared value creation. The average scores of three indicators of company A suppliers are 1.38 times, 1.42 times, and 1.49 times of the company B suppliers, respectively. From the proportion of the total score, company A’s overall ratio is 0.7, while the proportion of cooperation with the consumer is relatively low at 0.58. This indicates that company A suppliers have better performance in the implementation of GSCM. In contrast, the proportion of company B suppliers is relatively low, only the ratio of internal organizational activity and cooperation with the supplier is higher than 60%, and the remaining indicators are with lower scores ratios. This may be caused by the fact that company B does not have its own dedicated green supplier management standard system.

Figure 3 shows the impact of the implementation of GSCM on the business performance of the suppliers of company B and company A. The four indicators are environmental performance (including 7 items, out of 35 points), operational performance (including 6 items, out of 30 points), positive economic performance (including 9 items, out of 45 points), and negative economic performance (including 4 items, out of 20 points). It can be seen from Figure 3 that four indicators have a higher impact on company A than on company B, and GSCM practices have the greatest impact on the positive economic performance of company A. It suggests
that the implementation of GSCM brought larger economic benefits for company A enterprise. Although the values of other indicators are not affected as much as economic performance, they also have a positive impact to a certain extent and are worthy of implementation. Company B does not have a green procurement system related to it to constrain suppliers. Whether the enterprise passes the environmental impact assessment or has environmental protection awareness lies entirely in the individual enterprise, so the score is generally low. However, Company A introduced the “Company A Green Purchasing Guide”, which has made detailed selection criteria for suppliers and adopted measures to stop supply or meet the standards after non-standard suppliers, which has greatly promoted the supplier's green perception.

| Dimensions and items | λ  | Dimensions and items | λ  |
|----------------------|----|----------------------|----|
| Internal Organizational Activity | Cooperation With Consumer | | |
| OA1. Single-sector action mechanism to reduce environmental impact | 0.864 | OC1. Sharing of product green design | 0.951 |
| OA2. Group company's mechanism to reduce environmental impact | 0.865 | OC2. Low carbonization in the transportation process | 0.929 |
| OA3. Responsibility for reducing environmental impacts in the management policy | 0.868 | OC3. Packaging concept and design sharing to reduce the environmental burden | 0.929 |
| Eco-Design | Environmental Performance | | |
| ED1. Reduced design of raw materials, accessaries, and products | 0.899 | EP1. Waste reduction | 0.985 |
| ED2. Low carbon and environmentally friendly design during the use of the product | 0.881 | EP2. Waste gas emission reduction | 0.985 |
| ED3. Product design to improve logistics efficiency | 0.879 | EP4. Solid waste reduction | 0.924 |
| CSR Promotion | Operational Performance | | |
| CSR1. Corporate Social Responsibility (CSR) deployment settings | 0.862 | OP1. Product quality improvement | 0.976 |
| CSR2. Corporate Social Responsibility (CSR) special person in charge | 0.876 | OP2. Production efficiency improvement | 0.965 |
| CSR3. Preparation of CSR reports, green development reports, environmental information disclosure reports, etc. | 0.800 | OP3. Productivity improvement | 0.937 |
| CSV Promotion | Positive Economic Performance | | |
| CSV1. Import of new technologies to improve energy efficiency in the entire supply chain | 0.854 | PE1. Increased market share | 0.917 |
| CSV2. Optimization of distribution routes, the introduction of low-carbon transportation, etc. to improve logistics efficiency in the entire supply chain | 0.817 | PE2. Entering the new market | 0.924 |
| CSV3. Corporate Competitiveness Enhancement and Social Contribution Activities in Business Areas | 0.825 | PE3. Increase in the number of new customers | 0.908 |
| Cooperation With Suppliers | Negative Economic Performance | | |
| CS1. Supplier technical support to reduce environmental impact | 0.850 | NE1. Increase in procurement costs for environmental impact | 0.922 |
| CS2. Supplier education and training to reduce environmental impact | 0.853 | NE2. Increased training costs for environmental impact levels | 0.891 |
| CS3. Supplier information sharing to reduce environmental impact | 0.856 | NE3. Increase in investment in environmental impact levels | 0.882 |

Adjusted R-squared (%): 83.01 KMO: 0.628 Cronbach’s α: 0.962.

### 4.2. The interaction functions of internal and external GSCM practices

This paper used structural equation modeling (SEM) in AMOS 19.0 to analyze the effect of GSCM practices on the enterprise’s performance. This SEM analysis followed a strictly theory-driven, confirmatory method, as represented by MacCallum et al. (1993). The results indicate that the structure performs well on the data (As shown in Figures 4 and 5). Some 67% and 58% of the variation in corporate performance is explained by the external and internal variables in company A and company B, which confirms the comprehensive theoretical framework can benefit model explanation and fit. Model is acceptable with below fit statistics (NFI = 0.892, RMR = 0.054, RMSEA = 0.075, GFI = 0.922, Chi square = 657.1; NFI = 0.887, RMR = 0.052, RMSEA = 0.070, GFI = 0.911, Chi square = 622.3).

#### 4.2.1. The interaction effect of different internal GSCM practices

There are some interactions between organizational system & management technology and corporate value promotion. The results show...
that organizational system & management technology practices (including internal organizational activity and Eco-design) have a positive influence on the CSR and CSV promotion incorporation value promotion. This finding could be verified in both company A and company B corporate from Figures 4 and 5. In company A, internal organizational activity and Eco-design exert significant influence on CSR and CSV promotion, respectively ($\beta = 0.281; \beta = 0.396; \beta = 0.397; \beta = 0.619$). Compared with company A, company B has a smaller positive impact of initial activities (including internal organizational activity and Eco-design) on CSR and CSV promotion, respectively ($\beta = 0.281; \beta = 0.396; \beta = 0.397; \beta = 0.619$). This suggests that initial activities such as internal organizational activity and Eco-design have accelerated the process of promoting CSR and CSV to enhance corporate value. The impact of Eco-design on CSR and CSV promotion is particularly evident. This should be since CSR and CSV promotion is carried out under the comprehensive assistance of low-carbon related activity and organizational members. Also, these practices rely on low-carbon management technology implementation. Hence, hypothesis 1 has been supported.

4.2.2. The effect of internal GSCM practices on external GSCM practices

Enterprise not only needs to achieve internal environmental performance through the company’s green efforts but also depends on the cooperation and coordination of upstream and downstream members of the supply chain. This paper could notice that internal GSCM practices including organizational system & management technology and corporate value promotion have a positive influence on external GSCM practices such as cooperation with suppliers or consumers (As shown in Figures 4 and 5). The internal GSCM practices like CSV and CSR promotion not only take the higher requirement for suppliers but reduce environmental damage from consumer behavior. It can be seen that CSV promotion exerts more influence on cooperation with the consumer than CSR promotion in company A and company B ($\beta = 0.800 > 0.670; \beta = 0.734 > 0.682$). It suggests creating shared value (CSV) focused on the value of consumer experience, and actively converting consumers into participants in GSCM practices. However, corporate have started to implement CSV in recent years, they have not yet fully penetrated enterprises. Hence, hypothesis 2 has been supported.
4.3. The influential mechanism of GSCM practices on corporate performance

The internal and external GSCM practices taken by company A and company B have a significant positive effect on environmental performance, operational performance, positive economic performance, and negative economic performance (As shown in Figures 4 and 5, and Table 3).

4.3.1. The effect of GSCM practices on company A performance

In company A, internal organizational activity has the greatest influence on operational performance ($\beta = 0.668$). It verified that the implementation of GSCM will help improve the operational performance of the company such as product quality and productivity. For example, company A internal GSCM practices like Environmental Management System (EMS) could provide additional information resources to the corporate, and also affect the business process and performance related to the environment. Besides, internal organizational activity has a significant indirect influence on environmental performance ($\beta = 0.350$), positive economic performance ($\beta = 0.384$), and negative economic performance ($\beta = 0.043$) via cooperation with suppliers and customers. Eco-design has a positive influence on environmental performance ($\beta = 0.244$). This indicates that Eco-design could help reduce greenhouse gas emissions and energy consumption, which directly enhances the environmental performance of company A corporate. In company A, the effect of GSCM practices on business positive economic performance is greater than negative economic performance ($\beta = 0.576 > \beta = 0.237$). Although cooperation with suppliers could increase corporate negative economic performance, the GSCM practices could bring greater economic benefit to the corporate in total. This would form good competitive advantages for company A corporate in GSCM management in the automobile industry.
directly increase costs for corporate (producing green environmental protection concepts into the design will facilitate green procurement, the choice of environmentally friendly non-toxic raw materials will greatly increase the cost of raw material procurement, communication costs, and operating costs of the cooperation between corporate and upstream/downstream partners in green logistics and green marketing. Although internal organizational activity could indirectly promote positive economic performance, the GSCM practices brought a greater negative influence on corporate economic performance ($\beta = 0.664$) in total. Therefore, cooperation with suppliers will significantly improve the negative economic performance of company B.

5. Discussion and implication

5.1. Discussion

The present research compared the status of implementation of GSCM practices between company A and company B. Overall, company A scored higher than the score of company B, indicating that company A has done a better job in GSCM implementation. First, in the category of organizational system & management technology, the score of internal organizational activity on company A is higher than that of company B. Items that average score higher than 4 points for company A are related to environmental responsibility, green supervision mechanism, and ISO14001 management system. This finding is consistent with the measures of “company A Basic Concept” and “Contributions to the Sustainable Development of Society and the Earth.” It suggested that company A corporate has better implementation status of GSCM practices and a higher level of awareness of environmental management. The score of Eco-design for company A and company B is similar, indicating manufacturing already has a consciousness of green and constant improvement.

Second, in the category of corporate value promotion, company A manufacturing behaves a stronger sense of social responsibility. However, the lowest scores of the items refer to “CSR report, green development report, environmental information disclosure report, etc.” The popularity of environmental information disclosure is relatively low, and it is necessary to raise the awareness of manufacturers in this respect.

Third, in the aspect of CSV, the item “residual energy improves the energy efficiency of the entire supply chain” has a lower score. This reflects that manufacturers generally lack technical support and practical operations in the utilization of waste heat. Further improving the utilization efficiency of waste heat and popularizing it is worthy of attention.

Forth, in the category of the corporation outside, the “suppliers financial support of reducing environmental impact” item has the lowest score among indicators with 3.2 and 2.94 average points for company A and company B respectively. It shows that the suppliers are still worried about the additional capital investment caused by environmental protection, which causes the company’s profits to decrease. It is only intended to start implementation, but it has not determined the specific time.

Fifth, the score of the item of “introduction of common transportation system” is also about 3 points. Logistics is one of the main problems between suppliers and Original Equipment Manufacturers (OEMs). company A currently has some of its own logistics routes, but company B is still discussing the issue solution. Among the scores of items, company A and company B showed an intersection, indicating that these two manufacturers have advantages and disadvantages in terms of supplier linkage and need continuous improvement.

Sixth, the GSCM practices exert a positive significant influence on corporate performance for company A and company B. However, we are surprised to find that GSCM practices brought greater negative economic performance for company B while company A could benefit a lot from GSCM practices with significant positive economic performance. Company B, as GSCM’s initial development corporation, needs to increase environmental investment and cost of operation and training. This thereby increases the negative economic performance, and this increase in cost is very large at the beginning of GSCM implementation. Moreover, with the improvement of people’s living standards, green products are increasingly welcomed by the public (Basiri and Heydari, 2017). However, Eco-green design may bring some difficulty to the product developer in the initial design, the results of this study show it would add to the green cost for company B corporate. According to the survey on the automobile industry, most of China’s enterprises are in the initial stage of implementation without good experience and guidance, so negative economic performance is very significant. Compared with company B, company A has relevant strategic planning and management objectives in the field of green supply chain management and has set up environmental promotion courses to manage and promote the green supply chain management of enterprises (Kumar et al., 2016). It has contributed to promoting upstream enterprises to coordinate emission reductions, and produced a good effect of coordinated economic and environmental development. In general, company B suppliers who have not implemented green procurement pay more attention to the negative economic performance brought about by the implementation of GSCM practices. And the attention to environmental performance needs to be improved further. Company A suppliers who have implemented GSCM practices have a higher perception of environmental performance and believe that they have less impact on the economy.

### Table 3. Standardized coefficients for the direct and total effects of predictor variables on endogenous variables.

| Company A corporate | Company B corporate |
|---------------------|---------------------|
| Paths DE IE TE | Paths DE IE TE |
| OA → EP | -0.350 0.350 | OA → EP -0.310 0.310 |
| OA → OP | 0.668 -0.668 | OA → OP 0.542 -0.542 |
| OA → PE | -0.384 0.384 | OA → PE -0.274 0.274 |
| OA → NE | -0.043 0.043 | OA → NE -0.037 0.037 |
| OA → CSV | 0.396 -0.396 | OA → CSV 0.354 -0.354 |
| OA → CSR | 0.281 -0.281 | OA → CSR 0.321 -0.321 |
| OA → CS | -0.265 0.265 | OA → CS -0.223 0.223 |
| OA → CC | -0.317 0.317 | OA → CC -0.328 0.328 |
| ED → EP | 0.244 -0.244 | ED → EP 0.687 -0.687 |
| ED → NE | -0.067 0.067 | ED → NE -0.094 0.094 |
| ED → CSV | 0.619 -0.619 | ED → CSV 0.426 -0.426 |
| ED → CSR | 0.397 -0.397 | ED → CSR 0.343 -0.343 |
| ED → CS | -0.415 0.415 | ED → CS -0.435 0.435 |
| ED → CC | -0.495 0.495 | ED → CC -0.484 0.484 |
| CSV → NE | -0.108 0.108 | CSV → NE -0.105 0.105 |
| CSV → CS | 0.526 -0.670 | CSV → CS 0.734 -0.734 |
| CSV → CC | 0.634 -0.495 | CSV → CC 0.682 -0.682 |
| OP → PE | 0.576 -0.576 | OP → PE 0.312 -0.312 |
| OP → EP | 0.524 -0.524 | OP → EP 0.424 -0.424 |
| CS → NE | 0.161 -0.161 | CS → NE 0.664 -0.664 |

Annotation. DE: Direct Effect; IE: Indirect Effect; TE: Total Effect.
5.2. Policy recommendations

For public policymakers, it is necessary to appropriately promote the implementation of GSCM practices transferring from the factory to the headquarters of the automobile industry with increasing financial incentives. And the government should accelerate the formulation of national standards for automotive green products. Also, the government should establish a voluntary incentive mechanism that would attract more and more enterprises to participate in GSCM practices with guidance from the government. Besides, with the improvement of public environmental awareness, more and more consumers tend to choose green goods which of the price is slightly higher than that of traditional goods. Therefore, the willingness of many consumers to green goods is not strong. It is time that the government needs to vigorously promote public opinion and advocate green consumption. The government should promote the importance and urgency of environmental protection in the whole society, and create a good public opinion community for the implementation of green supply chain management. For the enterprise, green supply chain management should be incorporated into the company’s development plan. The enterprise should establish a green supplier management system, and clarify the green supply chain management objectives. To set up a special management organization, the enterprise should be responsible for the management of suppliers. At the same time, the supplier audit system and performance evaluation mechanism should be improved to fundamentally green the supply chain.

6. Conclusions

Our investigation has revealed some interesting findings in this regard.

In our study, GSCM practices including organizational system & management technology, corporate value promotion, and corporation with outside are all found to be significant determinants of corporate performance. For foreign-owned automobile companies with advanced green concepts, internal organizational activity has the greatest influence on operational performance and promotes corporate value and corporation with the outside. However, for a domestic automobile company, Eco-design exerts the greatest effect on environmental performance and also brought a negative economic impact on corporate performance. Moreover, although both CSR and SCV promotion could influence the corporation with consumers and suppliers, CSV promotion has a more positive influence on cooperation with consumers than that of CSR. Also, GSCM practices would bring both positive and negative economic performance, but there is a difference in the net economic performance among different automobile corporate.

Our study provides empirical support for the complementarity of the environmental management initiatives and supports the existing literature that GSCM practices can significantly improve the environmental performance of automobile corporate. However, although this paper has provided useful results, the large room for research improvement of auto enterprises and GSCM still exists due to the complexity, uncertainty, and exploratory nature. First, we implemented this investigation by self-reports. Self-report may contain social desirability bias, and long-term (if possible) observation is needed in future research. For instance, under the pandemic of COVID-19, the market demand of auto enterprises and the uncertainty of policies have made environmental performance and green supply chain management have contingency adjustment effects. The future research direction of this thesis lies in the perfection of supply chain management, the enterprise should be responsible for the management of suppliers. At the same time, the supplier audit system and performance evaluation mechanism should be improved to fundamentally green the supply chain.

Declarations

Author contribution statement

Xintao Li: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Diyi Liu: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Tongshun Cheng: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Li Liu: Analyzed and interpreted the data; Wrote the paper.

Jie Yuan: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

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