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The effect of sustainable supply chain management on business performance: Implications for integrating the entire supply chain in the Chinese manufacturing sector

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ABSTRACT

This paper proposes an integrative approach to exploring the contribution of supply chain management (SSCM) to business performance. Three dimensions of SSCM, i.e., inbound sustainability, internal sustainability, and outbound sustainability, were proposed. The conceptual model was tested in the context of the Chinese manufacturing sector using partial least squares structural equation modeling. The results showed that outbound sustainability was directly related to business performance, while inbound and internal sustainability indirectly affected business performance. The model also revealed that customer integration enhanced the relationship between internal sustainability and outbound sustainability. The results suggested that supply-side and demand-side sustainability had unique roles and that the entire supply chain should be integrated when exploring the link between SCCM and business performance. A supply-side collaborative advantage was necessary but not sufficient, and business performance was achieved only when demand-side value creation was realized. The findings emphasize the distinctive role of each dimension of SSCM and the importance of integrating the entire supply chain.

1. Introduction

Recent studies on sustainable supply chain management (SSCM) have assumed that working closely with supply chain (SC) partners leads to sustainable development and business advantages (Seuring and Gold, 2013; Vachon and Klassen, 2008). However, because of the inherent tensions between profitability and environmental and social integrity (Davis-Sramek et al., 2018; Xiao et al., 2019), the contribution of SSCM practices to firm performance is a longstanding topic of debate. Empirical evidence has paradoxically corroborated both the positive and the negative effects of SSCM on business performance (Paulraj et al., 2017; Yu et al., 2014; Zhu et al., 2007). These inconclusive results can be attributed to various factors, such as poor methodology, lack of theoretical foundation, the moderating effect of contingent factors, or the nonlinear nature of the relationship (Gimenez and Tachizawa, 2012; Ni and Sun, 2018; Ortas et al., 2014). Thus, there is a call for more effort to explore the link between SSCM and business performance.

This study proposes that one reason for the ambiguous link between SSCM and business performance is the inability to rethink the entire SC, especially to ignore the role of customers. Conventional wisdom suggests that the SC gains competitiveness by being fully integrated, including upstream suppliers and downstream customers (Walton et al., 1998). However, SSCM studies to date have treated different parts of the SC as independent entities, which have received uneven attention. While supplier coordination has attracted significant interest (de Sousa Jabbour et al., 2017; Quarshie et al., 2016), downstream customer relationships have received little attention, with a few exceptions (Wolf, 2011; Yu et al., 2014). An integrative perspective is lacking, as firms often require their suppliers or internal operations to execute individual actions without considering the potential adverse effects on total benefits (Lee, 2010). Research on collaboration with customers has been sparse and the role of customers has not been fully explored (de Sousa Jabbour et al., 2017). Consequently, current SSCM studies have only partially discussed improving business performance, as the entire SC is neither integrated nor streamlined.

This study proposes that good business performance is achieved when the entire SC is integrated and when demand-side customers are willing to pay for sustainable offerings (Priem and Swink, 2012).

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This proposition seems obvious but is often overlooked due to the lack of an integrated approach and ignorance of the role of customers (de Sousa Jabbour et al., 2017; Lee, 2010). To this end, we propose that SSCM consists of three dimensions, that is, inbound sustainability (InS), internal sustainability (IS), and outbound sustainability (OuS). InS refers to collaborative efforts with suppliers, IS refers to internal sustainable operations, and OuS defines the flow of sustainable outcomes to customers (Yu et al., 2014). OuS highlights the importance of value creation on the demand side, while inbound and internal sustainability underscore the supply-side collaborative advantage. We propose that good business performance is achieved when all three dimensions act as an integrated SC and supply chain integration (SCI) strengthens this integrative relationship. Specifically, outbound sustainability directly affects business performance and mediates the effects of inbound and internal sustainability. Applying the extended resource-based view (ERBV) and the demand-side approach (DSA), the conceptual model proposes an integrative approach to link SSCM and business performance and highlights the unique role of the supply side and demand side. The model embodies the recent call to encompass value creation on the demand side and collaborative advantage on the supply side (Blome et al., 2014; Christopher and Ryals, 2014).

This study makes several contributions to explore the link between SSCM and business performance. (1) Rather than simply asking whether SSCM affects business performance or what SSCM practices are related to business performance, the model explores how SSCM leads to business performance. (2) The distinct effects of the supply side and demand side are revealed. Indeed, most previous SSCM studies have focused on cooperation with suppliers but have rarely explored the role of the demand side in firm sustainability. (3) This study highlights the importance of coordinating the entire SC to achieve firm performance. Although previous studies have proposed similar concepts (e.g., Wong et al., 2015), different parts of the SC are still treated as isolated entities and an integrative approach is still lacking in current SSCM studies.

This paper is structured as follows. After the introduction, the paper reviews the background theories of the ERBV and DSA and presents the three dimensions of SSCM. A conceptual model linking SSCM, business performance, and SCI is then proposed. In the fourth section, Chinese manufacturing survey data are analyzed to test the conceptual model. Then the results are discussed to explain the theoretical and practical implications of the study. Finally, the paper concludes with a discussion of the limitations of the study and directions for future research.

2. Literature review

2.1. SSCM and business performance

Although SSCM has various definitions, SSCM essentially denotes the attempt to incorporate the triple bottom line of sustainable development (i.e., economic, environmental, and social goals) into the management of the SC (Roy et al., 2018). For example, Seuring and Müller (2008) explicitly discussed this notion when they defined SSCM as the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.

Ahi and Searcy (2013) further identified two characteristics, sustainability and the SC, as the basis for the definition of SSCM, which they defined as "The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems …" To propose an integrative approach to investigate the link between SSCM and business performance, we review these two characteristics below.

The sustainability characteristic concerns the simultaneous achievement of economic, environmental, and social performance. These three benefits are often in conflict because different stakeholders emphasize different dimensions. Many studies have even argued that trade-offs between the economic, environmental, and social dimensions are the rule rather than the exception given the multifaceted and complex nature of sustainable development (Hahn et al., 2010; Van der Byl and Slawinski, 2015). The negative relationship between sustainability and business performance is therefore of great concern. For instance, Golicic and Smith (2013) highlighted the negative link between SSCM and business performance in specific situations. However, an SC is only sustainable when it achieves realistic business performance (Liu et al., 2012) and the economic dimension is the first consideration in most SSCM-related decisions (Davis-Sramek et al., 2018). Therefore, the link between SSCM and business performance has attracted attention (Ambec and Paul, 2008; Barnett and Salomon, 2012; Kirchoff et al., 2016). This paper offers a new approach to this link.

The second characteristic of SSCM is coordination between partners. The conventional view emphasizes that business performance involves the integration of business operations both within and across the boundaries of an organization (Cooper et al., 1997). However, managing the SC in an integrated model is not easy. Barriers include the increasing complexity of coordination, the lack of communication between partners, the potentially higher cost of management, and managers' lack of capability (Seuring and Müller, 2008). As a solution, companies usually apply the sustainability principle internally or with suppliers and make less effort to integrate the entire SC, especially with customers (de Sousa Jabbour et al., 2017; Reefke and Sundaram, 2017). Suboptimization occurs when each partner attempts to achieve their own goal without considering the possible adverse influence on the other parties (Lambert and Cooper, 2000). The lack of integration across the entire SC impedes the path toward sustainability. One study simultaneously included upstream, downstream, and internal SC practices, but each was treated as an isolated entity and an integrated view of SSCM was still lacking (Chen et al., 2017; Golicic and Smith, 2013; Zhu et al., 2008). Lee (2010) described this approach as reactive and piecemeal and feared that well-intentioned individual actions may have unanticipated consequences, reducing the collective benefits. Therefore, Lee (2010) called for an integrative view of SSCM by rethinking the entire SC, which was done in this study.

2.2. Extended resource-based view

Unlike the resource-based view (RBV), which emphasizes that firms owning or controlling heterogeneous resources within their boundaries are able to gain a competitive advantage, the ERBV advocates that critical idiosyncratic resources go beyond firm boundaries (Lavie, 2006). Resources, assets, and skills from external links with alliances, suppliers, or customers are key determinants of competitive advantage (Popli et al., 2017). Dyer and Singh (1998), for instance, suggested that interorganizational relationships generate supernormal performance when partners are willing to invest in relationship-specific assets, exchange knowledge, mutually complement scarce resources, or use an effective governance structure. Therefore, the resources gained from integration with SC partners can provide a collaborative advantage, improving firm performance (Xu et al., 2014).

Three types of inter-firm rent are relevant to the dimensions of SSCM (Lavie, 2006). Internal rent comes from the focal firm's resources, which is connected to some extent to inter-firm resources.

Inbound spillover rent comes from the internalization by the focal company of the shared resources of its partners. Finally, outbound spillover rent is the outflow benefit of resources from the focal company to its partners. The ERBV therefore suggests that a company's performance results from the combined effects of the resources of its internal and external partners (Yang et al., 2018). As a result, integrating the entire SC to obtain the joint efforts of partners is necessary to achieve sustainable development.

2.3. Demand-side approach

The RBV and ERBV have been criticized for only capturing value from private or relational resources, in which one benefits from others' loss, rather than creating value for customers (Schmidt and Keil, 2013). In contrast, the DSA considers value creation as the primary source of competitive advantage (Priem and Swink, 2012). Value is the customers' perceived utility or their willingness to pay for an offering. It is produced through a value system, which usually consists of a series of firms conducting value-added activities along the SC. Collaborative advantage is valuable only if it produces an output that customers are willing to pay for (Schmidt and Keil, 2013). As a result, the value of supply-side resources is determined by value creation on the demand side. Therefore, the effect of the entire SC, both supply-side value capture and demand-side value creation, should be considered when exploring the contribution of SSCM to performance (Pagell and Shevchenko, 2014).

The DSA emphasizes the role of customers, providing a new approach to linking SSCM and business performance. The supply-side collaborative advantage that creates value for customers on the demand side leads to a competitive advantage. As a result, combining the supply-side collaborative advantage with demand-side value creation makes it possible to explore the effect of the entire SC. Therefore, the DSA and ERBV complement each other to explain how SSCM leads to business performance. The DSA has received less attention than the supply side in SC research. Indeed, SC research has mainly focused on the effects of internal and supplier practices without considering value creation on the demand side. However, recently, the DSA has started to attract more attention. For instance, Hunt and Davis (2008) incorporated the DSA into the competitive advantage of the SC by differentiating resource advantages from market position advantages. The meta-analysis of SSCM and firm performance by Golicic and Smith (2013) and Skilton (2014), conceptualizing the tensions between value creation for customers and value capture by suppliers, are other examples of DSA-based research.

2.4. Dimensions of SSCM

The SC can be defined as a way to link structured activities to produce an output for a particular customer or market (Ellram and Cooper, 2014). At the heart of this definition are the integration and coordination of SC activities. The main activities fall into three broad processes, i.e., activities with original suppliers, internal operating activities, and activities with customers (Cooper et al., 1997). These three broad processes have been widely accepted in SC research. For instance, integration research has developed the concepts of customer integration, supplier integration, and internal integration to cover all three processes (Chang et al., 2016). In the logistics field from which the SC originates, the flow of materials involves three successive processes, namely inbound logistics (activities with suppliers), internal operations, and outbound logistics (activities with customers; Mentzer et al., 2001). Therefore, achieving sustainability means improving the sustainable performance of all three processes (Gimenez and Tachizawa, 2012; Gold et al., 2010).

Based on these three processes, this study proposed three dimensions of SSCM, namely InS, IS, and OuS. InS involves fostering sustainability on the supplier side to ensure sustainable requirements for inbound materials and services (Rao and Holt, 2005). This dimension has often been studied under the theme of green purchasing or sustainable supply (Green et al., 2012; Hollos et al., 2012). Two typical InS strategies are supplier assessment and collaboration (Gimenez and Tachizawa, 2012). Supplier assessment includes monitoring, auditing, or evaluating a supplier's sustainability performance, while supplier collaboration refers to the training, support, or joint efforts of suppliers to achieve sustainable goals. IS refers to internal operational practices for sustainable objectives (Liu et al., 2012; Wong et al., 2012). These initiatives result in sustainable products or processes. For instance, a series of practices may be developed to integrate sustainability into traditional operations, such as environmental or social certification, waste or energy consumption reduction, internal training or involvement programs, eco-design, or environmental management systems (Gimenez et al., 2012; Zhu et al., 2012). Finally, OuS refers to the offering of sustainable products or services to customers (Carter and Rogers, 2008). This dimension is essential to competitiveness and is the focus of green marketing or distribution (Liu et al., 2012). OuS emphasizes the role of customers in connecting SSCM and competitive advantage, highlighting the need for a customer orientation to link supply-side activities with demand-side value creation (Miocevic and Crnjak-Karanovic, 2012).

These three dimensions should not be considered as silos. Instead, they work together as an integrated system. Indeed, OuS is the goal of the entire chain, i.e., to create customer value on the demand side, while InS and IS are its supply processes. According to the ERBV, InS is a type of inbound spillover rent that the focal company can internalize from supplier sustainability. In addition, IS provides internal rent from its internal operations. Finally, OuS provides outbound spillover rent to its customers with respect to sustainability (Lavie, 2006). These three dimensions form an integrated system for achieving sustainability, in which the sustainability of the upstream process affects the sustainability of the downstream process.

Several studies have proposed similar dimensions of SSCM. For example, Zhu et al. (2007) and Wong et al. (2012) separated internal sustainability from external sustainability. Rao and Holt (2005) and Caniato et al. (2012) proposed that SSCM activities should cover all SC processes, including inbound, internal, and outbound functions. However, a silo mentality still prevails and an integrated approach is still lacking. An integrative approach to SSCM incorporating the entire SC has not yet received the attention it deserves (Yu et al., 2014). As a result, this study contributes to the literature by applying the ERBV and DSA to explore the relationship between the three dimensions of SSCM.

3. Hypothesis development

3.1. Relationship between the dimensions of SSCM (H1, H2)

InS is the input to internal operations, in which suppliers provide raw materials and components that influence the sustainable operations of the company. As suppliers are committed to sustainability and incoming materials meet sustainability requirements, according to the ERBV, InS provides inbound spillover rent that the company can internalize to improve its performance (Lewis et al., 2010). A good choice for the focal company is to internalize the incoming sustainability of the suppliers (Lavie, 2006). Indeed, investing in internal resources makes it possible to exploit external resources (Xu et al., 2014). That is, firm-specific resources are needed to develop the absorptive capacity to

internalize the benefits of InS (Saenz et al., 2014). Therefore, investing in sustainability on the supplier side positively influences investment in the sustainability of the focal company.

Some sustainable outcomes also require collaborative solutions between suppliers and the focal company (Luzzini et al., 2015). Supplier investment in sustainability facilitates collaborative solutions. Investing in IS is attractive when the behaviors and outcomes of suppliers are predictable and the risk of opportunism is preventable (Ni and Sun, 2018). The ERBV demonstrates that this partnership is managed under an effective governance mechanism (Lavie, 2006). Collaborative solutions and effective governance are isolating mechanisms that prevent the mobility, imitability, and substitutability of the relational rent generated. Therefore, the focal company is willing to invest in internal sustainability to achieve a relational advantage. Overall, the inbound sustainability of the suppliers will directly affect the implementation of internal sustainability within the focal company, which leads to the following hypothesis:

H1. Inbound sustainability (InS) has a positive effect on internal sustainability (IS).

The SC is a system for creating customer value (Lambert and Cooper, 2000) and IS is the production process of OuS. Investing in IS increases the ability to offer products/services that are environmentally and socially responsible. The proposition of a positive effect of IS on OuS is thus reasonable due to their relationship along the SC. The ERBV explains the underlying logic by assuming theoretical relationships between resources, capabilities, and performance across organizational boundaries (Skilton, 2014). Investing internally in sustainability provides the company with sufficient resources, both tangible and intangible, to meet customer requirements and needs for sustainability. The focal company is thus capable of generating outbound spillover rent to create customer value. Therefore, by catering for internal resources or capabilities, IS provides outbound spillover rent, specifically to customers. According to the ERBV, we propose the following hypothesis:

H2. Internal sustainability (IS) has a positive effect on outbound sustainability (OuS).

3.2. The effect of SSCM on business performance (H3, H4, H5)

To be truly sustainable, firms must provide environmental and social benefits within a realistic financial structure. The DSA is used to link SSCM with business performance. The DSA considers customers' *willingness to pay* as the determinant of the performance implications of SSCM (Priem et al., 2012). Customers' willingness to pay determines the value created by the entire SC and brings a competitive advantage (Zander and Zander, 2005). Although heterogeneous resources and capabilities can generate economic rent, the DSA insists that rent from external collaboration and internal operations should create value for customers (Priem and Butler, 2001). That is, on the one hand, external and internal resources are needed to provide offerings to customers. On the other hand, the value of resources is determined by the market, while the offerings that customers are not willing to pay for are valueless and will not lead to superior business performance (Priem et al., 2013). In other words, the DSA implies that sustainability outcomes for the entire SC should ultimately serve the purpose of customer value creation if improving business performance is one of the goals.

As OuS is the sustainable offerings made to customers, OuS is expected to directly affect business performance. Therefore, we propose the following hypothesis:

H3. Outbound sustainability (OuS) has a positive and direct effect on business performance (BP).

However, the DSA does not exclude the importance of the collaborative advantage of the entire SC in providing sustainable offerings (Priem and Swink, 2012). Without coordinating the activities of SC partners on the supply side, value creation on the demand side is impossible. Indeed, by using the DSA with the ERBV, the value created by the entire SC answers the questions of "value for whom" and "how to create value," two critical considerations in generating a business advantage. In other words, when focusing on demand-side value creation, the suppliers and internal operations of the firm deserve equal attention (Levitas, 2013).

We propose that IS and InS affect business performance indirectly and through the mediating effect of the demand side. Collaborative advantage among SC partners, while necessary for value creation, is not sufficient in itself to generate business performance (Priem and Swink, 2012). Specifically, IS is the production process of OuS and is a necessary step to offer sustainable offerings. Nevertheless, its contribution to business performance is achieved when customers are willing to pay. Consequently, IS is related to business performance through the mediating effect of OuS.

This rationale applies to the effect of InS on business performance. A slight difference lies in the fact that the mediating effect not only refers to OuS, but should also consider the role of IS. As Hollos et al. (2012) proposed, for SSCM to lead to superior performance, it is necessary to combine the efforts of suppliers and those of the focal company.

Taking all of the above arguments together, we propose the following two hypotheses to explain the mediating effect of the integrated SC on the relationship between InS and IS and business performance:

H4. Internal sustainability (IS) has no direct effect on business performance (BP). Instead, OuS mediates the effect of IS on business performance.

H5. Inbound sustainability (InS) has no direct effect on business performance (BP). Instead, IS and OuS mediate the effect of InS on business performance.

3.3. Moderating role of SCI (H6, H7)

SCI is the degree of engagement with suppliers and customers, and two elements of SCI are collaboration and coordination (Leuschner et al., 2013). The coordination mechanism allows firms to obtain accurate and timely information on the sustainability of their partners, to better identify related sustainable issues and effectively prevent the associated risk of potential violation (Schoenherr and Swink, 2012). Ongoing and intensive information exchange makes partners' opportunistic behaviors identifiable and preventable (Flynn et al., 2010; Yu et al., 2013). Strong SCI also implies a good understanding of the capabilities and goals of partner organizations in achieving sustainability. Partners are willing to collaborate on collective solutions that benefit the sustainable operations of the SC (Nyaga et al., 2010). Therefore, SCI can catalyze SSCM by reducing complexity and enhancing coordination and communication.

Greater supplier integration (SI) strengthens the relationship between Ins and IS. Intensive integration with suppliers helps foster partner-specific absorptive capacity. The focal company develops a specific ability to identify, assimilate, and apply the valuable knowledge of a supplier. As the ERBV suggests, SI is beneficial for the development of mutual trust, mutual information exchange, and long-term collaboration for the more efficient use of internal resources or relational resources (Schoenherr and Swink, 2012;

Zacharia et al., 2011). As the company has more knowledge of ways of developing the sustainability of its suppliers, internal investment in sustainability is an attractive strategy to internalize all relationship-specific benefits. Therefore, we propose the following hypothesis:

H6. Supplier integration (SI) positively moderates the relationship between InS and IS.

Integration with customers is another source of relational rent (Zhou et al., 2014). The benefits of CI, such as intensive information exchange, long-term collaboration, and joint problem solving, streamline the assimilation of customer knowledge and skills to improve the ability to offer sustainable products or services (Zander and Zander, 2005). Increased customer integration reflects the company's willingness to invest in internal sustainability, due to either customer pressure or a better understanding of customers' needs. Customers' awareness of or pressure for environmentally friendly products or services and socially responsible operations stimulate firm-level sustainable development (Sarkis et al., 2010). Therefore, CI helps the company build a customer orientation strategy to achieve specific sustainability goals (Liu et al., 2013; Rao, 2002). The output of the SC is valuable when it creates value for customers. In short, intensive integration with customers increases the understanding of customer needs, enhances the company's ability to offer sustainable offerings, and increases its effectiveness in creating value for customers. Therefore, we propose the following hypothesis:

H7. Customer integration (CI) positively moderates the relationship between IS and OuS.

The hypotheses are summarized in a conceptual model, as shown in Fig. 1.

4. Methodology

4.1. Research context

The conceptual model was tested in the Chinese context. China's rapid economic growth over the last four decades has caused serious sustainability problems, such as air pollution, water contamination, and the rapid consumption of non-renewable resources (Zhu et al., 2007). Companies have been forced to find ways to balance economic benefits with environmental and social responsibility. Sustainability issues are particularly challenging for the Chinese manufacturing sector, as this sector consumes most of the country's resources and energy. However, SSCM activities have mainly been implemented to meet regulatory requirements (Shi and Zhang, 2006). Therefore, how proactive sustainability practices can contribute to business performance is a major concern in the Chinese context.

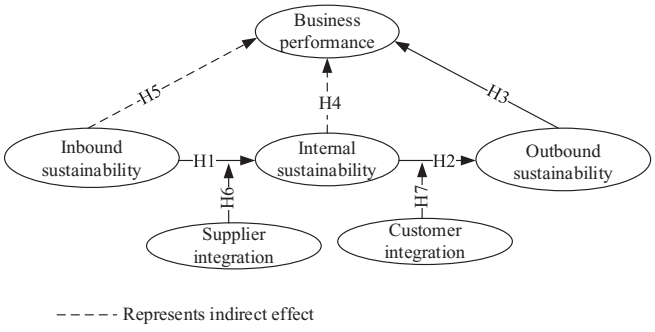

Fig. 1. Conceptual model and hypotheses.

4.2. Measurement instrument

The measurement instrument was part of the sixth round of the International Manufacturing Strategy Survey (IMSS), based primarily on the literature on SCI and SSCM, and is presented in the appendix. The IMSS investigates manufacturing and SC strategies across 21 countries in Europe, North America, South America, and Asia. Other studies have used earlier rounds of IMSS data specifically related to firm sustainability or SC management, such as Frohlich and Westbrook (2001), Gimenez et al. (2012), Vanpoucke et al. (2014), Wiengarten et al. (2014), and Golini and Kalchschmidt (2011).

As previously mentioned, SSCM had three dimensions. InS was measured as the focal company's monitoring and collaboration with suppliers to achieve inbound environmental sustainability (Vachon and Klassen, 2006). This measurement was consistent with that of other studies (e.g., Seuring and Müller, 2008). OuS is the company's sustainable output to its customers and society in terms of products and processes. IMSS uses two questions to measure OuS: "win orders from major customers with more environmentally friendly products and processes" and "win orders from major customers with a higher contribution to the development and welfare of society." This measurement was comparable to Hervani and Helms's (2005) measurement of the green SC. IS was measured as environmental management practices or programs, such as environmental certification or training programs, energy consumption or pollution emission reduction programs, and water conservation or recycling programs. These activities have often been mentioned in sustainable SC studies (e.g., Seuring and Müller, 2008).

The economic dimension of the triple bottom line usually refers to financial performance at the firm level (Hubbard, 2009; Paulraj et al., 2017). Therefore, the narrowest conception of business performance, i.e., financial only, was adopted (Venkatraman and Ramanujam, 1986). The measure of business performance included both growth and profitability and was measured by asking the respondents to indicate the extent of performance change in sales and return on sales over the last three years. These two indicators have been widely used in business studies to measure business performance by including both growth and profitability (Venkatraman and Ramanujam, 1986).

SCI was measured as logistics integration, which refers to the degree of cooperation in information and material flows along the SC, and as technological integration, which refers to the degree of cooperation in product and process design or knowledge sharing. Indeed, SCI occurs both upstream (supplier integration) and downstream (customer integration; Frohlich and Westbrook, 2001). The IMSS measurement instrument for SCI has been used in other studies (e.g., Vachon and Klassen, 2006; Wong et al., 2011).

4.3. Sampling and data collection

The data were collected in fall 2013. The Chinese version of the IMSS questionnaire was prepared from the original English version. Using a measurement instrument developed in another language involves special care to preserve its reliability and validity in translation. The committee approach recommended by Cha et al. (2007) was used, and several critical steps were taken to ensure that the Chinese version was culturally acceptable and appropriately translated. The original English version was independently translated into two Chinese versions, which were then sent to two other bilingual translators from local universities who back-translated them into English independently. Next, the differences

between the back-translated and the original English versions were identified by two MBA students with work experience in foreign-owned and domestic companies in eastern China. The differences and clarifications were shared with the translation team. A single Chinese version was then revised based on the discussions. The revised Chinese version was further examined by the authors and the two MBA students to ensure idiomatic, experiential, grammatical, syntactic, and conceptual equivalence (Cha et al., 2007). The management practices and action programs of the original English version and the revised Chinese version were specifically checked to ensure their equivalence and the contextual accuracy of Chinese terminology. This step led to many subtle but critical revisions of the Chinese version. Finally, the translation was sent to four manufacturing firms in Zhejiang Province, eastern China. The first author and one MBA student met with each manufacturing director or vice president of operations and examined each question to verify that the questionnaire content was correct and consistent. Any ambiguity or discrepancy between the English and Chinese versions was noted and the Chinese version was revised according to the English version and the advice given by the companies.

IMSS explores manufacturing practices and trends. The geographical distribution of the Chinese sample was intentionally restricted to eastern and central China. The sample included the provinces of Jiangsu, Zhejiang, Shandong, and Guangdong, the four most industrialized and developed areas of eastern China. In addition, it included the province of Hubei, a heavy industrial manufacturing base in central China. Heilongjiang Province, a traditional manufacturing base in northeastern China, where large and state-owned manufacturing companies are located, was also included. These areas are currently facing serious environmental and sustainability problems. Pressure from government regulations and customer concerns about sustainability are extremely strong, providing an ideal context for studying SSCM.

Companies corresponding to the IMSS industry types and considered as leading firms in these industries were invited to take part in the survey. The target respondents were the director of operations or an equivalent position to ensure their knowledge of the survey-related activities. The respondents were asked to rate their firm's level of implementation or performance on a 5-point Likert scale, ranging from 1, "low level of implementation or performance," to 5, "high level of implementation or performance." Two hundred questionnaires were sent by mail and 133 were returned. As the IMSS is a lengthy survey consisting of nine pages and more than 250 questions, missing data posed a major threat to the validity of this study. Twenty-three cases were excluded from the study due to numerous missing data on questions related to the topic of interest. These cases were classified as non-response, resulting in a sample size of 118 and a response rate of 59%. A *t*-test showed no significant difference in company size (number of employees; $t = -1.509$), sales ($t = -0.901$), or return on sales ($t = -0.076$) between response and non-response (or excluded) cases, eliminating the problem of non-response bias.

4.4. Common method bias

The data collection method took some steps to reduce the problem of common method bias (Gimenez et al., 2012): (1) the questionnaire was completed by operations/manufacturing directors or equivalent positions, (2) the confidentiality of the respondents' information was guaranteed and protected, and (3) questions related to this study were scattered across different sections of the questionnaire.

However, as the data were collected in the same session and from single sources, the problem of common method bias had to be scrutinized. To this end, Harman's single-factor test was conducted following the traditional procedure of loading all items into an exploratory factor analysis (Podsakoff et al., 2003). The total variance explained by factors with eigenvalues greater than 1 was 73.1%, while the largest eigenvalue factor accounted for 28.9%. As no single factor accounted for the majority of the covariance among the measures, the concern about common method bias can be removed.

5. Analysis and results

We used SmartPLS software to conduct partial least squares structural equation modeling (PLS-SEM). This analysis technique was preferred because of the following methodological advantages. First, it places minimum requirements on sample size and residual distribution to achieve sufficient statistical power and robustness (Hair et al., 2013b). Considering our relatively small sample size, PLS-SEM was the most appropriate method. Second, PLS-SEM is tolerant of non-normal data, which was one of the concerns of our study. Third, it is an appropriate test of models with continuous moderators, such as the model in this study (Hair et al., 2012).

A common rule of minimum sample size for robust PLS-SEM is 10 times the maximum number of paths leading to endogenous constructs (Hair et al., 2012), suggesting that the minimum sample size of 30 was sufficient for this study. Therefore, a sample size of 118 was appropriate to test the hypotheses using PLS-SEM.

5.1. Measurement model results

5.1.1. Reliability

"Reliability" refers to the consistency of a measurement. Three types of reliability coefficients were examined: Cronbach's alpha, composite reliability (CR), and the Spearman-Brown coefficient. Cronbach's alpha was used as the lower boundary of internal consistency reliability and CR as the upper boundary of true reliability (Hair et al., 2013b). However, for a two-item scale, Cronbach's alpha is inappropriate and meaningless, so the alternative Spearman-Brown coefficient was reported (Eisinga et al., 2013). As a general rule, reliability coefficients (Cronbach's alpha and CR) of 0.70 or higher are considered adequate (Nunnally, 1978). The reliability coefficients in Table 1 were all above 0.80, except for the alpha value of business performance, which was 0.769, above the cutoff value of 0.7. Therefore, the measurements showed adequate reliability.

5.1.2. Validity

The validity of a measure indicates whether an instrument measures what it is supposed to measure. Convergent validity was demonstrated by the average variance extracted (AVE) values, which were all above the recommended cutoff value of 0.5 (Hair et al., 2013b). Indicator reliability was also examined. The indicator loadings on their corresponding constructs were all greater than 0.8, above the commonly recommended value of 0.708, and the *t* values (between 16.23 and 83.81) showed that all loadings were significant at 0.01 (Hair et al., 2013a). Discriminant validity was assessed by two criteria. First, as shown in Table 1, the square root of the AVE for each construct was greater than the correlation coefficients with the remaining constructs. Second, as shown in Table 2, the indicator loadings on their corresponding constructs were all greater than their loadings on other constructs (i.e., the loadings were higher than the cross-loadings).

5.2. Results of the structural model

In the first step, the structural model included two direct effects

Table 1
Reliability and validity of the measures.

Constructs	Alpha	CR	AVE	SI	CI	InS	OuS	IS	BP
Supplier integration (SI)	0.889	0.923	0.750	**0.886**					
Customer integration (CI)	0.914	0.939	0.795	0.753	**0.891**				
Inbound sustainability (InS)	0.862	0.916	0.784	0.526	0.471	**0.885**			
Outbound sustainability (OuS)	0.814[a]	0.914	0.842	0.377	0.381	0.323	**0.918**		
Internal sustainability (IS)	0.892	0.925	0.756	0.532	0.483	0.632	0.502	**0.870**	
Business performance (BP)	0.769[a]	0.888	0.799	0.286	0.349	0.283	0.511	0.427	**0.894**

The boldface diagonal values are the square roots of the average variance extracted (AVE).
[a] The Spearman-Brown coefficient is used for two-item measures (Eisinga et al., 2013).

Table 2
PLS cross-loadings of the indicators.

Indicators	SI	CI	InS	OuS	IS	BP
SI1	0.84	0.67	0.39	0.28	0.44	0.29
SI2	0.90	0.72	0.49	0.32	0.46	0.25
SI3	0.85	0.54	0.41	0.34	0.37	0.17
SI4	0.87	0.66	0.51	0.36	0.55	0.27
CI1	0.67	0.90	0.37	0.34	0.42	0.35
CI2	0.68	0.92	0.46	0.40	0.46	0.38
CI3	0.71	0.88	0.45	0.30	0.47	0.22
CI4	0.63	0.86	0.40	0.29	0.37	0.27
InS1	0.49	0.43	0.87	0.32	0.62	0.34
InS2	0.48	0.44	0.93	0.31	0.58	0.22
InS3	0.42	0.38	0.86	0.22	0.45	0.17
OuS1	0.29	0.33	0.21	0.90	0.41	0.40
OuS2	0.39	0.37	0.37	0.94	0.50	0.53
IS1	0.37	0.35	0.39	0.39	0.85	0.29
IS2	0.54	0.49	0.58	0.51	0.87	0.50
IS3	0.47	0.45	0.59	0.47	0.92	0.38
IS4	0.44	0.37	0.60	0.36	0.83	0.27
BP1	0.29	0.31	0.23	0.44	0.37	0.89
BP2	0.23	0.31	0.28	0.47	0.39	0.90

hypothesized to be indirect (H4, H5). The mediating effects are discussed in the next section. Fig. 2 shows the results of the structural model.

First, collinearity between exogenous variables was tested using the latent variable scores of the SmartPLS results by regression (Hair et al., 2013a). The values of the variance inflation factor (VIF) were distributed between 1.39 and 2.63, below the threshold of 5 (Hair et al., 2013a), indicating that the collinearity problem was not serious between the exogenous variables.

R^2 indicates the percentage variance of the endogenous variables explained by the model. As shown in Fig. 2, their predictors explained 31.6% of the variance in business performance, 50.7% of the variance in internal sustainability, and 29.7% of the variance in outbound sustainability. According to Chin (1998), R^2 values of 0.67, 0.33, or 0.19 are considered substantial, moderate, and weak values, respectively. Thus, our R^2 values were weak to moderate or moderate to substantial. These R^2 values were adequate to demonstrate the good predictive effect of the predictors on the predicted variables.

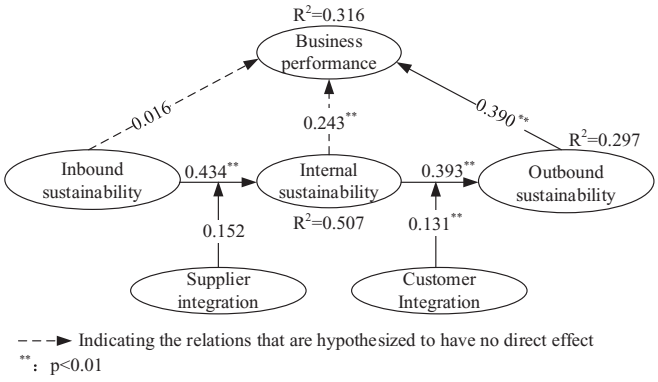

Fig. 2. Testing results of the conceptual model and hypotheses.

We then assessed the path weights. InS (path = 0.434, $t = 3.742$, $p < 0.01$) had a positive effect on IS, and IS (path = 0.393, $t = 6.663$, $p < 0.01$) had a positive effect on OuS, thus H1 and H2 were supported. In addition, OuS (path = 0.390, $t = 7.120$, $p < 0.01$) had a positive effect on business performance, so H3 was supported. However, InS had no significant effect on business performance (path = 0.016, $t = 0.194$, $p > 0.1$), so no direct effect of InS on business performance was found. Conversely, IS had a positive effect on business performance (path = 0.243, $t = 3.141$, $p < 0.01$). Finally, SI had no significant moderating effect on the link between InS and IS, while CI (path = 0.131, $t = 2.185$, $p < 0.05$) had a significant direct moderating effect on the link between IS and OuS. Therefore, the results fully supported H7 but not H6.

5.3. Test of mediating effects

To test the mediating effects, the bootstrap method (resample n = 1000) was used to examine the significance of the direct and indirect effects. This step excluded the two moderators. The bootstrap method is popular for investigating indirect effects and has a methodological advantage over the Sobel test (Preacher and Hayes, 2008). Table 3 presents the bootstrap results. Only the direct effect of IS on BP was significant at the $p < 0.05$ level. The direct effect of InS on BP was not significant at the $p < 0.05$ level. However, the two indirect effects were significant at the $p < 0.01$ level. Specifically, OuS partially mediated the effect of IS on BP, the direct effect being also statistically significant. In addition, IS and OuS fully mediated the effect of InS on BP. The results of the 97.5% confidence intervals further confirmed the significance of the mediating effects. All of the lower level values were greater than 0. The results thus confirmed that supply-side sustainability affected business performance through the integrated SC. Indeed, the demand-side construct, OuS in this study, played a key role in connecting supply-side constructs with business performance.

6. Discussion and implications

6.1. Theoretical implications

The question of how SSCM contributes to improving business performance remains unanswered, as an integrated approach to SSCM has received little attention. Indeed, although the role of the supply side has attracted interest, the effect of the demand side has been less explored, and each has been treated as an independent entity rather than an integrated chain. This study analyzed three dimensions of SSCM and examined how they were integrated to contribute to business performance. We also considered the

Table 3
Results of testing the mediating effects.

Hypothesis	Predictor variable	Mediating variable	Dependent variable	Direct effect	Indirect effect	Total effect	97.5% Confidence Interval for the indirect effect	Support for mediating effect
H4	IS	OuS	BP	0.240*	0.199**	0.439	0.103, 0.308	Partial supported
H5	InS	IS OuS	BP	0.017	0.294**	0.310	0.144, 0.457	Supported

**: $p < 0.01$; *: $p < 0.05$.

moderating effect of SCI. The empirical results showed that OuS fully mediated the effect of InS on business performance and partially mediated the effect of IS on business performance. In addition, CI strengthened the relationship between IS and OuS. These results have several theoretical implications for SSCM research.

First, this study highlights the distinct role of the demand side in achieving sustainability. The results indicated that OuS acted as a bridge between the supply side of SSCM and business performance. This suggests that when customers are willing to pay for sustainable offerings, a real link between SSCM and business performance can be expected. This result may be obvious, but it is often overlooked when supply-side practices are directly related to business performance (Luzzini et al., 2015). Based on these results, we argue that the customer is the foundation of sustainability, similar to the classic wisdom stating that the customer is the foundation of business (Priem and Swink, 2012; Zander and Zander, 2005). The sustainability requirements of stakeholders, such as governments, communities, and NGOs, that apply to all industry players should serve as order qualifiers rather than order winners. Consequently, meeting the requirements of these stakeholders does not contribute to performance. Improving business performance is only possible when a sustainable offering meets the needs of customers. To answer the question of whether "it pays to be green or good," the question of who pays for it is important. Customer value creation is the ultimate goal of the SC (Lambert and Enz, 2017). However, this goal has often been ignored in SSCM research as most studies have been devoted to the supply side (Lee, 2010; Luzzini et al., 2015). Therefore, we call for more effort to investigate how SSCM contributes to value creation on the demand side to explore its link to business performance.

Second, the study reveals the different roles of supply-side and demand-side practices in achieving sustainability. We treated both InS and IS as supply-side practices. IS and OuS fully mediated the effect of InS on business performance and OuS partially mediated the effect of IS on business performance. These results indicated that working closely with suppliers and investing internally to achieve firm-level sustainability was necessary but not sufficient to improve business performance. According to the DSA, supply-side practices offer a collaborative advantage and its value is realized when creating market value for customers (Schmidt and Keil, 2013). Therefore, when acknowledging that supply-side collaboration leads to resource advantage (Hunt and Davis, 2008), one should also recognize that resources gain value from customers' use (Priem and Swink, 2012). The ultimate value of supply-side resources is determined by customer evaluation on the demand side. In addition, investing internally is necessary to absorb supplier sustainability and contributes to demand-side value creation. Previous studies have confirmed the mediating effect of internal operations on the link between external supplier relationships and performance improvement (Zhu et al., 2012). This study adds the importance of demand-side value creation. However, the direct effect of supply-side sustainable practices on business performance has often been assumed by overlooking the mediating effect of the demand side (Leuschner et al., 2013; Yu et al., 2014). Therefore, more research is needed to rigorously explore the relationship between supplier sustainability, internal operations, and business performance. In this regard, the DSA should be a useful theoretical lens for conceptualizing this relationship.

The direct effect of IS on business performance was also significant. This implies that while value creation is essential to achieve business performance, other mechanisms also influence the effect of IS on business performance. For example, reducing waste or saving resources may directly affect business performance (Gimenez et al., 2012).

Third, this study contributes to the integrated approach to link SSCM to business performance. We theorized that SSCM had three dimensions, InS, IS, and OuS. Specifically, InS and IS emphasize the supply-side collaborative advantage and OuS highlights demand-side value creation. The results confirmed the distinctive effect of each dimension in exploring the link between sustainability and business performance. Indeed, supplier collaboration was necessary but not sufficient for SSCM. In addition, IS served as the absorptive capability to internalize InS. Finally, customer collaboration was essential for value creation on the demand side. In this way, the three dimensions of SSCM formed an integrated SC to provide sustainable offerings to end customers. The results also indicated that CI strengthened the relationship between IS and OuS, providing further support for the integrated approach and the significant role of customers in achieving sustainability.

The integrated approach explored the effect of the entire SC and simultaneously highlighted the distinctive effect of each component. Although the supply side was necessary to offer sustainability, the effect of the supply-side collaborative advantage was mediated by the demand side to create customer value. Moreover, the link between SSCM and business performance was significant when customers acknowledged sustainability. Therefore, this study suggests that SSCM can be profitable but only until sustainability satisfies customers. When exploring the link between SSCM and business performance, the effect of the entire SC should be considered. The integrated approach has recently been favored to rethink gaps in previous SSCM studies (Lee, 2010; Priem and Swink, 2012). Therefore, this study contributes to the literature by proposing the components of SSCM and offering evidence of the link between SSCM and business performance.

6.2. Practical implications

Based on the above discussion, we recommend discouraging the incorrect assumption that sustainability generates additional costs and thus reduces profits. This incorrect assumption often prevents firms from pursuing a proactive sustainable strategy. Indeed, the results suggest that firms should implement a more proactive SSCM strategy.

A proactive SSCM strategy should involve working with both supply-side and demand-side partners and delivering sustainable outcomes to create customer value. Managers must understand the distinct roles of suppliers and customers and the role of internal functions when working toward sustainability. Moreover, the integrated approach suggested that managers should consider the

effect of the entire SC when initiating SSCM programs. A piecemeal SSCM will not be effective as the gains of an individual process may be detrimental to other processes. In addition, the value captured on the supply side may be valueless on the demand side if customers deny its usefulness. Therefore, managers need to understand what customers want, then develop internal sustainable practices and collaboration with suppliers to provide the resources and capabilities needed to create customer value. Sustainability can only be achieved through a system-wide structural change, covering the entire SC.

7. Conclusions and future research

This study empirically tested an integrated approach to SSCM. It suggested that distinct components and different partners of SSCM have a unique effect on sustainability. This study makes the following contributions to SSCM research. First, the three proposed components of SSCM, i.e., inbound, outbound, and internal sustainability, constitute a recent development and contribution to this field. This proposal suggests that different partners make different contributions to sustainability. Therefore, we call for more research devoted to investigating the role of customers and how collaboration between partners contributes to value creation on the demand side, instead of focusing solely on value capture on the supply side. In addition, the supply-side collaborative advantage is necessary to offer sustainability, but its value is evaluated on the demand side. Therefore, the integrated approach provides a broader view of SSCM. Second, this study concludes that business performance is achieved when customer needs are met and customers are willing to pay for environmentally friendly or socially responsible products or services. Therefore, future research should focus on examining "the relationship between SSCM and business performance" rather than whether "SSCM is related to business performance." Third, this study showed the potential complementarity of the DSA and ERBV in exploring the link between SSCM and business performance. The ERBV is useful for revealing the supply-side collaborative advantage. However, it does not discuss demand-side value creation. In contrast, the DSA emphasizes demand-side value creation. However, whether the entire system has sufficient resources and capabilities to create customer value is not covered. As a result, combining the DSA and ERBV underlines the importance of the supply-side collaborative advantage and demand-side value creation. The integrated approach is thus able to explain how SSCM leads to business performance.

This study has some limitations that offer directions for future research. First, although we proposed an integrated approach, we did not discuss technical or practical guidelines to integrate the entire SC to achieve sustainability. Many studies have focused on supply chain integration with respect to the traditional economic goal. However, integrating the entire supply chain to achieve sustainability remains challenging. Therefore, future studies should address this topic (Wolf, 2011). Second, the integrated SC may evolve and be dynamic because of environmental dynamics and complexity (Ni and Sun, 2018; Skilton, 2014). As static study based on sectional data cannot answer these meaningful questions, a longitudinal case study may help advance knowledge. A noticeable gap in SSCM research is that different studies have investigated different aspects of performance (Golicic and Smith, 2013). This was also the case for the current study, which is our third limitation. We focused on business performance without including the social and environmental dimensions of TBL. We measured business performance in its financial dimension only, not considering other performance aspects such as market and manufacturing. Therefore, further research is needed to provide a more rigorous and consistent performance measurement (Beske-Janssen et al., 2015; Hubbard, 2009).

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Appendix. Measurement scales

Code	Measures
	Inbound sustainability (Seuring and Müller, 2008)
InS1	Suppliers' sustainability performance assessment through formal evaluation, monitoring and auditing using established guidelines and procedures
InS2	Training/education in sustainability issues for suppliers' personnel
InS3	Joint efforts with suppliers to improve their sustainability performance
	Outbound sustainability (Hervani and Helms, 2005)
OuS1	Win orders from customers with higher contributions to the development and welfare of society
OuS2	Win orders from customers with more environmentally sound products and processes
	Internal sustainability (Seuring and Müller, 2008)
IS1	Environmental certification (e.g., EMAS or ISO 14001)
IS2	Formal sustainability-oriented communication, training programs, and involvement
IS3	Energy and water consumption reduction programs
IS4	Pollution emission reduction and waste recycling programs
	Supplier integration (Vachon and Klassen, 2006; Wong et al., 2011)
SI1	Sharing information with key suppliers (e.g., sales forecasts, production plans, order tracking, and tracing, delivery status, stock level)
SI2	Developing collaborative approaches with key suppliers (e.g., supplier development, risk/revenue sharing, long-term agreements)
SI3	Joint decision-making with key suppliers (e.g., product design/modifications, process design/modifications, quality improvement, and cost control)
SI4	System coupling with key suppliers (e.g., vendor managed inventory, just in time, Kanban, continuous replenishment)
	Customer integration (Frohlich and Westbrook, 2001; Vachon and Klassen, 2006)
CI1	Sharing information with key customers (e.g., sales forecasts, production plans, order tracking, and tracing, delivery status, stock level)
CI2	Developing collaborative approaches with key customers (e.g., risk/revenue sharing, long-term agreements)
CI3	System coupling with key customers (e.g., vendor managed inventory, just in time, Kanban, continuous replenishment)
CI4	Joint decision making with key customers (e.g., about product design/modifications, process design/modifications, quality improvement, and cost control)
	Business performance (Venkatraman and Ramanujam, 1986)
BP1	Return on sales
BP2	Sales

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