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Sustainable supply chain management practices and performance

Abstract

Purpose –The aim of this paper is to contribute significantly to the empirical investigations related to the impact of Sustainable supply chain management (SSCM) practices on performance in Chinese firms. The paper also aims to theorize and empirically assess a comprehensive SSCM practices and performance model. The model incorporates two aspects of SSCM practices: internal and external management, and analyses the impact on corporate sustainability performance from all dimensions.

Design/methodology/approach – This paper develops a conceptual model to investigate the impact of SSCM practices on the firm performance. Based on the data of 172 Chinese firms, this paper analyzes the impact of SSCM practices on firm economic performance, environmental performance and social performance for each dimension by PLS structural equation methods.

Findings –The results show that firm internal SSCM practices have a positive impact on firm environmental performance and social performance. Moreover, environmental performance and social performance are positively related to economic performance.

Originality/value – A comprehensive SSCM practices performance model is proposed and empirically assessed for Chinese firms. The results of this investigation support the hypotheses that SSCM practices are environmentally and socially necessary mean while do goods to business. A series of approach and implications of SSCM practices is recommended.

Keywords Sustainable supply chain management, Sustainable operations, Firm performance, Emerging economies, China

1. Introduction

The most widely definition of sustainable development is "development necessary to meet the needs of contemporary people, they cannot destroy the ability of future generations to meet their own needs" by the World Environment and Development Organization. Sustainability is becoming a key topic in companies' strategic agendas(MIT, 2009). Corporates often operate under the triple bottom line theory by Elkington (1998) proposed the concept to balance economic, environmental and social issues from a micro perspective. In recent years, Firms have had a growing concern with the social parties for sustainable development and have paid more attention to social responsibility and environmental practices, while timely releasing Corporate Social Responsibility (CSR) reports and environmental reports (Wan Nurul Karimah, 2016). Firms implemented SSCM through environmental programs (such as design recycle product, environmental certification) and social practices (such as programs aimed to improve employees' working conditions or support the community activities) (Eduardo Ortas, 2014).

With the concept of sustainable development and improved awareness of environmental protection and social responsibility, SSCM has rooted in individuals and organizations. Managers need to consider the public environmental and social responsibility attitudes and values. SSCM can be seen as part of the corporate innovation processes in dynamic business development which is imperative for the survival and development of corporate (Gosling, Jonathan León-Bravo, 2017). Typically, the supply chain firms take responsibility for the negative effects of all members among the supply chain (Rao and Holt, 2005; Kovacs, 2008). Core enterprises need to be more responsible for environmental performance and social performance for the entire supply chain (Seuring and Muller, 2008). Therefore, firms implement the SSCM process, not only for the sustainable management of their own, but also for

the management of all the supply chain members. Supply chain core enterprises should improve environmental and social performance by internal SSCM meanwhile by external SSCM management to avoid and minimize the negative impact of the supply chain members in environmental and social responsibility (Claudia Neumüller, 2016).

This study examines the deployment of SSCM for internal and external practices for Chinese firms, analyzes their impact on economic, environmental and social performance meanwhile the impact of environmental and social performance on economic performance. This study makes a significant contribution to the on-going research that relates the sustainable practices on performance outcomes in a new framework. Furthermore, data are collected from China, a developing country with an increasing global business presence, but of which very little SSCM research has been carried out. A series of approach and implications of SSCM practices is recommended for Chinese firms and other emerging economy.

2. Literature review

2.1 Adoption of SSCM:

The term sustainability integrates social, environmental and economic responsibilities. Kleindorfer et al. (2005) used the term to illustrate environmental management, closed-loop supply chains and thought that it integrated profit, people and the planet into corporate culture, strategy and operations from a broad perspective under triple bottom line. SSCM is defined as the set of skills and leverages that allow a company to structure its business processes to achieve sustainable performance (Eduardo Ortas et al., 2014). SSCM refers to a firm's plans and activities that integrate environmental and social issues into supply chain management in order to improve the company's environmental and social performance and that of its suppliers and customers without compromising its economic performance (Seuring and Muller, 2008; Pagell and Gobeli, 2009). This definition implies that firms adopt programs to improve the environmental and social impacts on their internal processes (e.g. the production processes within their plants) and initiatives to improve the impact on their suppliers' and customers' processes (Elcio M. Tachizawa, 2014).

Despite the history of sustainability, its application to the supply chain has only emerged since the end of the 1980s (Maloni and Brown, 2006). While, most SSCM research addressed issues such as the environment protection or social responsibility separately without considering the potential interrelationships amongst these and other aspects of social responsibility (Carter and Jennings, 2002).

The sustainability movement began with a focus on environmental issues. And there were many research literature for the Green Supply Chain Management (GSCM) (Ahi and Searcy, 2013). Gilbert (2000) defined as GSCM was integrating environmental thinking into supply chain management (SCM). Srivastava (2007) defined as GSCM was adding "green" component to SCM. Zhu and Sarkis (2007) defined GSCM that covered all phases of a product's life cycle from design, production and distribution to the use of products by the end users and its disposal at the end of product's life cycle. Wantao(2014) argued SSCM integrates GSCM and CSR into SCM to maximize the performance from all dimensions.

In recent years with the emerging economies, more developing countries have realized the important the environment protection and CSR , there were more research on sustainable and green supply chain in BRICs countries from different industry such as India (Sharma 2015;Raut,2017),Brazil(Teixeira, Adriano Alves,2016; de Oliveira Neto, Geraldo Cardoso,2016) and China(Flynn, Andrew,2017).

2.2 SSCM practices

The definition of SSCM reveals that the firms improve their internal processes through environmental and social practices (for example: the production process), as well as improve the supplier processes.

Nathalie (2014) pointed out that environmental considerations have to be integrated into corporate culture and business planning at all stages through design, manufacturing, distribution and disposal. In the literature, numerous articles examine the individual stage impact (design, manufacturing, distribution and recycling) on environmental performance. For example, Azzone and Noci (1996) developed an approach to evaluate the environmental performance of new products. With respect to manufacturing processes, Rothenberg et al. (2001) and King and Lenox (2001) studied the interaction between lean initiatives and environmental performance. Regarding logistics, Quariguasi Frota Neto et al. (2008) developed a framework for the design and evaluation of sustainable logistics networks in which profit ability and environmental impacts are balanced. Other authors have analyzed the economic impact of recycling programmers (e.g., Dobos and Floriska, 2007).

Increasing consumer awareness of products and manufacturing conditions compels enterprises to adopt sustainable practices. Social sustainability in the supply chain has received growing attention in the recent years, due to growing awareness on equity, health and safety, education, and bonded labor and ethical practices in corporate (David Eriksson, 2015). Social sustainability practices in the supply chain has primarily emphasized legislative and health and safety issues rather than cultural and ethical issues (Seuring, 2004; Linton and Klassen, 2007; Seuring and Muller, 2008; Carter and Easton, 2011; Ashby et al., 2012; Seuring, 2013). The social sustainability of the supply chain depends on individual companies, and a supply chain often has many partner members, including manufactures and suppliers (Ashby et al., 2012). Social sustainability will help a firm to achieve a high level of benefits; otherwise may be adversely affected by poor social reasonability management (David Eriksson, 2015).

SSCM is facing significant challenges because each separate individual among the supply chain can affect the performance of other supply chain members. Supplier is the most important external member which will affect the supply chain performance (Christian Busse, 2016) and supplier's environmental and social crisis has a profound impact on the performance and reputation for the core enterprise. Core enterprise should extend the management boundaries from internal to the vendor partner. The supplier monitor and assessments system is particularly important. Firms have gradually realized that the firm development strategy should extend from the traditional corporate management to management for supply chain partners (Kytile and Ruggie, 2005). Research on the role of environmental collaboration has mainly focused on its antecedents and performance implications (e.g. Zhu et al., 2013; Grekovaet al., 2016). Collaborative planning, forecasting and replenishment systems help organizations to easily overcome financial barriers as well, which lead to the successful achievement of sustainability initiatives in supply chain (Attaran, 2007).

2.3 Performance measures in implementing SSCM practices

The triple bottom line concept suggests that firms not only need to engage in supply chain performance evaluation but engages in socially, environmentally related behaviors. SSCM looks to improve environmental and social performance of companies in the supply chains (Seuring and Müller, 2008; Bai and Sarkis, 2010; Gold et al., 2010; Amann et al., 2014). Teuteberg and Wittstruck (2012) identified three dimensions of performance – environmental, operational and social for SSCM (Zhu et al., 2005; Azevedo et al., 2011). For economic performance can be a more comprehensive index to evaluate the firms' economic status in the industry (De Giovanni and Esposito Vinzi, 2012; Green et al.,

2012). Therefore, different from other studies focusing on SSCM for one or two of the operational, environmental and social performance, this paper aims to study a variety of environmental and corporate social responsibility practices including internal and external management and their impact on corporate sustainability performance all dimensions.

A recent review of literature on SSCM (Seuring and Muller, 2008; Elcio M. Tachizawa, 2014) showed that few papers consider all dimensions of sustainability simultaneously (economic, environmental and social). However, there are relatively few research on the impact of external management for firm economic, environmental and social performance. And compared with the study in Brazilian companies (Chiappetta Jabbour, 2016) and (Shradha Ashok Gawankar, 2017) for Indian companies, there are little research specifies Chinese firms for empirical study.

3. Research framework and hypotheses

For the measurement of firms' sustainable management practices, this paper illustrates the internal management and external management and we give the all dimensions SSCM performance analysis. Below are the hypotheses and research framework.

3.1 Internal management and firm performance

3.1.1 Internal environmental management practices and firm performance

Resource-based view (RBV) connects environmental practices and environmental performance. Empirical studies such as Zhu and Sarkis (2004), Zhu et al. (2005), Philip Beske(2014) have pointed out that the implementation of environmental practices (e.g. waste management, environmental management systems, quality management, product design) could lead to better environmental performance. Therefore, we assume that:

H_{1EE}: Internal environmental management practices have a positive impact on firm environmental performance.

Social sustainability focused on internal and external parts. Environmental management practices could be expected to have a positive impact on both parts. For example, a clean production line can decrease pollution emissions as well as change the working conditions of employees and the community environment; furthermore improve the firm social reputation. Therefore, we assume that:

H_{1ES}: Internal environmental management practices have a positive impact on firm social performance.

Kassinis (2003) noted that the high investment of environmental protection activities will result in poor economic performance. However, in the literature of strategic research emphasizes corporates integrate environmental responsibility with the economic strategy can reduce the use of resources and improve stakeholder relations and brand image which can increase revenue. Zhu and Sarkis (2004), Zhu et al. (2005) and Rao and Holt (2005) supported that environmental management practices positively impact on economic performance. At the firm level, the use of more environmentally friendly materials and processes could improve production efficiency and reduce the use of resources, and ultimately reduce production costs. Therefore, we assume that:

H_{1EF}: Internal environmental management practices have a positive impact on firm economic performance.

3.1.2 Internal social responsible management and firm performance

By CSR management, employee involvement and training positively relate to environmental improvement (Florida, 1996). KolkAns(2016) argued that more CSR management involved in internal for their employee and external for the community or customers will all improve the public

environment protection awareness and do goods to firm environment performance. Based on Florida (1996) and Marshall et al. (2005), we expect the environmental performance driven by firm social responsibility practices has been improved. Therefore, we assume that:

H1_{SE}: Internal social responsible management practices have a positive impact on firm environmental performance.

CSR management practices include two parts (internal staff and external communities). Practices of Internal(for employee safety, working conditions)and the external(for community or the customer)all could be able to improve both firm social reputation and social performance. Therefore, we assume that:

H1_{SS}: Internal social responsible management practices have a positive impact on firm social performance.

Helen Walker (2012) argued that Firms improve employee safety and working conditions which can improve employee satisfaction and avoid accidents, and ultimately increase productivity and reduce loss. Therefore, we expect firms implement social responsible management to increase production efficiency. Therefore, we assume that:

H1_{SF}: Internal social responsible management practices have a positive impact on firm economic performance.

3.2 External Supplier management and firm performance

For external management, there is a gap between supply chain theory and sustainable practice (Bowen et al., 2001). With the development, more and more firms found out that supplier is the most important external member which will affect the supply chain performance (Christian Busse, 2016). In order to strengthen the supply chain environmental protection and social responsibility values, many firms begin to establish supplier assessment system or suppliers partnership development.

3.2.1 Supplier monitor and assessment and firm performance

We will take the transaction cost theory (TCT) and RBV to analyze the effect. According to TCT, transaction cost is a vital factor for transaction mode selection between firms and suppliers. Transaction costs include direct costs from the relationship management and potential opportunity costs from decisions management.

Some suppliers may exhibit unethical behavior in environmental and social responsibility or non-compliance with the law. In order to reduce the risk of such acts, firms need to adopt costly supplier monitor management and assessment mechanisms. Monitor practice focuses on assessing the actual supplier's performance and monitor the supplier potential unreasonable actions. Supplier may be required to report all safety chemical storage components, or guarantee their operations in line with the SA8000 standard labor rights and so on. Monitor and assessment for supplier about environmental factors and social factors are important for supply chain. Gimenez (2013) have pointed out that monitor and assessment for supplier have a positive effect on the environmental performance. Therefore, we expect firms use monitor and assessment methods to reduce supplier risk, thereby improving environmental and social performance. Therefore, we assume that:

H2_{ME}: Supplier monitor and assessment have a positive impact on firm environmental performance.

H2_{MS}: Supplier monitor and assessment have a positive impact on firm social performance.

3.2.2 Suppliers Collaboration and firm performance

Suppliers Collaboration could include many levels such as operations, information and strategy etc (Lamming and Hampson, 1996). Collaboration with supplier stresses the mutual value rather than

for a specific short-term task (Vachon and Klassen, 2006). According to RBV, valuable and scarce resources and capacity are the competitiveness for business which is non-duplicated and bring intangible resources to corporate development (Hart, 1995). Carter and Rogers (2008) pointed out that intangible resources, such as mutual learning and understanding of the nature and customer can promote the environmental performance.

Good supplier relationship will bring benefits to SSCM. Pagell et al. (2010) emphasized that partnership will develop trust for each other and they will be more possibly involved in social issue which brings sustainability. Therefore, we assume that:

H2_{CE}: Suppliers collaboration has a positive impact on firm environmental performance.

H2_{CS}: Suppliers collaboration has a positive impact on firm social performance.

Gimenez Cristina and Sierra Vicenta (2013) pointed out that supplier assessment and collaboration have a positive impact on economic performance. Monitor for suppliers and supplier collaboration can help firms achieve higher production efficiency and lower emission of waste. The fewer resources consumption may lower the production costs. Therefore, we assume that:

H2_{MF}: Supplier monitor and assessment have a positive impact on firm economic performance.

H2_{CF}: Suppliers collaboration has a positive impact on firm economic performance.

3.3 Interaction of firm performance

Firm environmental and social responsible activities are special resources for companies. Compared with competitors, firms are better able to achieve energy conservation, the environment protection, accidents avoided, as well as higher reputation status, etc. These are valuable resources and intangible assets for any organizations. Compared with their competitors, firms that have a higher level of environmental performance and social performance will have a higher status in the industry and higher satisfaction and loyalty for customers and stakeholders, which is more cost-effective. Therefore, we assume that:

H_{EF}: Environmental performance has a positive impact on economic performance.

H_{SF}: Social performance has a positive impact on economic performance.

Based on the literature review and the above hypotheses as stated, Figure 1 outlines the conceptual framework to be empirically tested in this research.

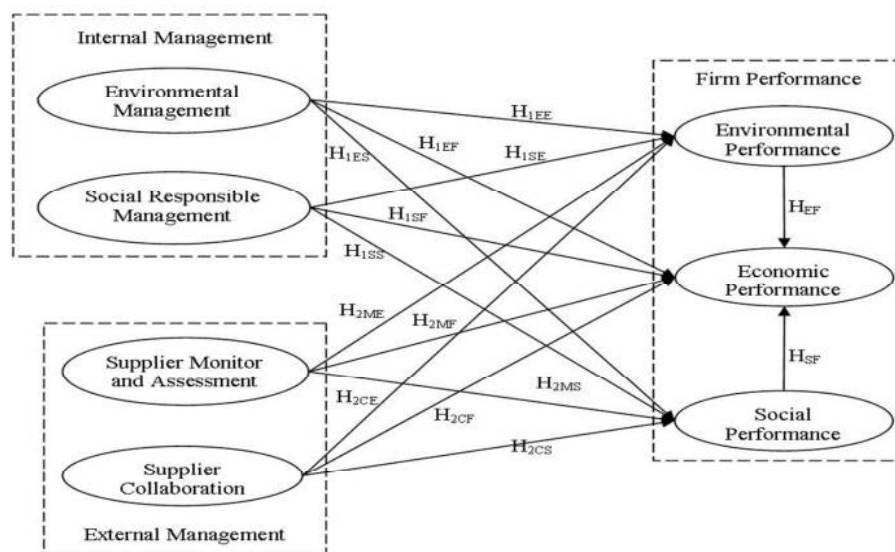


Figure 1 – Theoretical Model

4. Methodology

4.1 Survey questionnaires and measures

The survey instrument used for this research has been built accordingly to literature. The questionnaire included multiple items for each of the employed constructs. Scales were derived from literature. They were marginally modified to accommodate environmental and social aspects and to minimize the number of items belonging to each scale. Table A1 in appendix provides an overview of the questions employed by the instrument and the reference from which measures were derived. Measures are discussed below.

Internal environmental management is a second-order variables, including eco-design products, sustainable packaging, three sub-dimensions environmental protection management. Product eco-design has been measured by a seven-item scale, reference from Carter et al. (2000), Zhu et al. (2005) and Wantao Yu et al. (2014). Sustainable packaging products have been measured by a six-item scale, reference from Dang, Shuo (2016) and Zailani et al. (2012). Environmental protection management has been measured by an eight-item scale, reference from Zhu et al. (2005) and Zsidisin and Hendrick (1998).

Internal social responsible management is a second-order variables, including human rights, and Philanthropy. Human rights can be measured by a six-item scale, reference from Carter and Jennings (2002) and Emmelhainz and Adams (1999). Philanthropy can be measured by a four-item scale, reference from Carter and Jennings (2002). Safety management can be measured by a three-item scale, reference from Carter et al (2002) and. Zhu et al. (2005).

Supplier monitor and assessment is assessed by a nine-item scale measure. Similar metrics are proposed and validated by literature from Krause et al. (2000) and Carter et al. (2000).

Supplier collaboration is assessed by an eight-item scale measure. Similar metrics are proposed and validated by literature from Krause et al. (2000), Bowen et al. (2001) and Claudia Neumüller et al.(2016).

Firm sustainable performance includes three parts: economic performance, environmental performance and social performance. Economic performance can be measured by a six-item scale, reference from De Giovanni et al. (2012) and Green et al.(2012). Environmental performance can be measured by an eight-item scale, reference from Daily et al. (2007) and Zhu et al. (2004). Social performance can be measured by a six-item scale, reference from Kassinis and Soteriou (2003) and Gimenez et al. (2012).

4.2 Data collection

In order to ensure that SSCM initiatives had been adopted and implemented at the company organizations level by respondent organizations, the sampled population was limited to companies who had received ISO14001 and ISO9001 certification in China. Previous studies show that experience in implementing ISO14001 and ISO9001 scheme leads companies to implement SSCM initiatives (Darnall et al., 2008; Zhu et al., 2008; Jabbour ,2015). Considering this company focus, data were collected from a sample of operating-level managers working for Chinese firms organizations. The instrument was pre-tested by experts in the implementation of SSCM in China.

Data were collected following a survey approach. We obtained an original sample of 670 firms (mainly manufacture and retail firms) located in Beijing, Tianjin and the Yangtze River Delta region randomly by the form of interviews or e-mail. A total of 172 companies provided useful and complete information for this research. The effective response rate is 25.7%(Peng and Lai 2012), which was

considered sufficient for studying the research hypotheses. Characteristics of the distribution of the sample firms are shown in Table 1.

Table 1 – Descriptive statistics

Characteristics	%
Ownership	
State-owned	39.5%
A private sector	26.2%
A joint venture	12.8%
A Foreign direct investment enterprise	21.5%
Number of employees	
Less than 100	12.8%
100-499	23.8%
500-999	7.0%
1000-4999	20.9%
Not less than 5000	35.5%
Firm age (years)	
Less than 10	18.0%
10-19	33.2%
20-29	24.4%
Not less than 30	24.4%
Annual sales volume (In Millions, CNY)	
Less than 5	5.2%
5-9	4.1%
10-49	6.4%
50-99	11.0%
100-299	12.8%
Not less than 300	60.5%
Industry Type	
Manufacture	62.8%
Retail	25.6%
others	11.6%
Number of years the firm involved in SSCM initiatives	
Not involved	33.7%
Involved	66.3%
Less than 1	4.7%
1-2	9.9%
3-4	14.5%
Not less than 5	37.2%

In this paper, we use T-test to compare the two survey methods for the collection of samples if there are differences in firm characteristics and the main variables, the results show that the two methods of questionnaires was homogeneous and has no difference.

4.3 Data analysis

The hypotheses of the conceptual model were tested based on empirical data by means of structural equation modeling(Peng and Lai 2012) using partial least squares (Peng and Lai 2012) with the support of the software Smart-PLS 2.0. Using Smart-PLS 2.0, the research model was analyzed with partial least square-structural equation modeling (PLS-SEM) approach (Lee et al, 2013; Ringle Wende, & Will, 2005).

The reason we choose PLS is because of its minimal demand measurement scales, distribution assumptions and that it can test complex conceptual frameworks. Structural equation modeling is a second-generation multivariate statistical analysis method that has gained attention in the areas of green management (Rivera-Torres 2011; Pereira-Moliner et al. 2012) and operations management (Peng and Lai 2012). The test of the conceptual model involves obtaining a measurement model (outer model) and a structural model (inner model).

5. Research results

5.1 Measurement model

Many criteria were considered to guarantee the reliability and validity of our measures.

Composite reliability (C.R.) and Conbach's alpha analyze the reliability of the measurement scale. C.R. values of the variables in this study between 0.8801 to 0.9678, Conbach's alpha values in between 0.8179 to 0.9649 (see Table 2), must be greater than the threshold recommended in the literature 0.70, indicating herein scale has good reliability degree level (Peng and Lai 2012).

Measures' loading with their respective construct and average variance extracted (AVE) evaluate the convergent validity. In general, the index of factor loadings greater than 0.70 and significant at the 0.01 level indicates that the measurement has good convergent validity. As shown in Table 2, all indicators of factor loadings are greater than 0.70 and at 0.01 significance level, and AVE values are also higher than the recommended critical value 0.50, indicating that the measurement of this article has a very good convergent validity.

Table2. Summary of measurement scales

<i>Items</i>	<i>Loading</i>	<i>T-value*</i>	<i>C.R.</i>	<i>AVE</i>	<i>Alpha</i>
Eco-design (D1)					
D11	0.845	22.458			
D12	0.9145	49.2871			
D13	0.89	23.9693			
D14	0.9068	36.5778	0.9493	0.7286	0.9369
D15	0.8719	21.361			
D16	0.7461	9.3687			
D17	0.7867	14.6337			
Sustainable packaging (D2)					
D21	0.8384	18.5315			
D22	0.8536	20.9528			
D23	0.9004	36.0235	0.936	0.7094	0.9175
D24	0.8423	17.2981			
D25	0.8429	23.6541			
D26	0.7709	13.121			
Environmental protect Management (D3)					
D31	0.9072	41.9393			
D32	0.9049	45.2893			
D33	0.8662	21.4662			
D34	0.8877	30.2173	0.9597	0.7488	0.9518
D35	0.8577	26.8876			
D36	0.7918	16.6436			
D37	0.8548	23.4875			
D38	0.8469	18.4869			
Human rights(D4)					
D41	0.6851	8.4047			
D42	0.6125	12.1311			
D43	0.7557	10.472	0.8801	0.6498	0.8179
D44	0.8807	30.7813			
D45	0.8852	34.0211			
Philanthropy(D5)					
D51	0.8664	18.0319			
D52	0.9379	52.417	0.9438	0.8077	0.9201
D53	0.9204	43.1974			
D54	0.868	25.319			
Safety(D6)					
D61	0.9016	28.3053			
D62	0.9193	17.6733	0.9376	0.8336	0.9002
D63	0.918	23.8324			
Supplier monitor and assessment (E8)					
E81	0.8878	31.5104			
E82	0.8493	22.0073			
E83	0.8944	22.7594			
E84	0.9256	56.0978	0.9624	0.7408	0.9555
E85	0.8743	34.125			
E86	0.8316	20.6022			
E87	0.7061	10.6667			
E88	0.889	24.7266			

E89	0.8696	23.4068			
Supplier collaboration (E9)					
E91	0.8695	25.6988			
E92	0.8068	16.5679			
E93	0.8701	26.3465			
E94	0.8753	31.1731	0.964	0.7701	0.9571
E95	0.9067	34.7373			
E96	0.8364	18.2737			
E97	0.9275	59.9202			
E98	0.9212	56.8551			
Economic performance (F1)					
F11	0.8697	30.1607			
F12	0.8656	30.4593			
F13	0.7041	9.2415			
F14	0.891	35.7084	0.9459	0.7459	0.93
F15	0.9086	50.2129			
F16	0.9243	53.7611			
Environmental performance (F2)					
F21	0.8923	32.7809			
F22	0.8625	24.9829			
F23	0.8981	38.5215			
F24	0.9288	58.0511	0.9597	0.7732	0.9509
F25	0.8552	26.4216			
F26	0.8709	27.2988			
F28	0.8443	21.2361			
Social performance (F3)					
F31	0.8602	23.4971			
F32	0.8884	34.4632			
F33	0.8364	17.6448			
F34	0.9179	40.9296	0.9572	0.7886	0.9462
F35	0.9172	43.7189			
F36	0.9051	37.1658			
Internal environmental management*					
D1	0.9198	49.9889			
D2	0.8671	27.6682	0.9678	0.5895	0.9649
D3	0.902	30.9083			
Internal social responsible management*					
D4	0.8233	14.6853			
D5	0.8558	25.0402	0.9183	0.5084	0.9015
D6	0.7677	14.121			

Table3. Constructs validity

	D1	D2	D3	D4	D5	D6	E8	E9	F1	F2	F3
D1	0.8536										
D2	0.7618	0.8423									
D3	0.7228	0.6429	0.8653								
D4	0.4786	0.3792	0.4987	0.8061							
D5	0.5368	0.4684	0.5717	0.5591	0.8987						
D6	0.5133	0.5433	0.5477	0.4936	0.4534	0.9130					
E8	0.605	0.5951	0.626	0.5469	0.6326	0.4104	0.8607				
E9	0.5524	0.5227	0.5706	0.3841	0.5512	0.2931	0.7822	0.8776			
F1	0.4769	0.467	0.524	0.3891	0.4715	0.4966	0.4726	0.4591	0.8637		
F2	0.593	0.5625	0.656	0.5071	0.5791	0.5392	0.5916	0.5684	0.7138	0.8793	
F3	0.5052	0.4889	0.5583	0.4744	0.472	0.5404	0.469	0.4075	0.6721	0.7887	0.8880

Note: the square root of the AVE is reported on the diagonal. The latent construct correlations are reported off-diagonals.

Concerning to discriminate validity, table 3 shows that the correlations among the different constructs in the lower left off-diagonal of the matrix are lower than the square roots of the average

variance extracted values calculated for each of the constructs along the diagonal (i.e., diagonals elements). This testifies discriminate validity of our measures.

5.2 Structural model

The PLS structural model was assessed by examining the path coefficients and their statistical significance. Then, bootstrapping was used to test the statistical significance of model paths. This procedure entails generating 500 sub-samples of cases randomly selected for replacement from the original data.

Results for tests of the propositions are shown in figure 2.

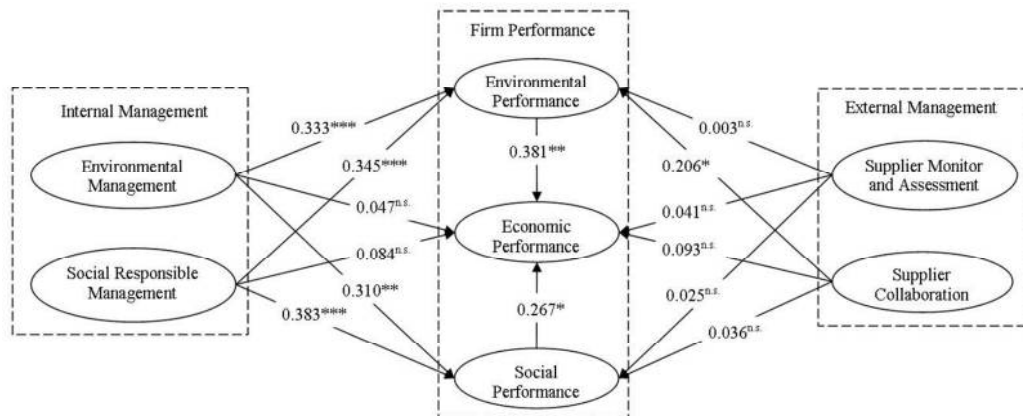


Figure2 - PLS structural model results

The impact of internal environmental management on environmental performance and social performance is positive and strongly significant, supporting H_{1EE} and H_{1ES}. The impact of internal social responsible management on environmental performance and social performance is positive and strongly significant, supporting H_{1SE} and H_{1SS}. The impact of Supplier collaboration on environmental performance is positive and significant, supporting H_{2CE}.

Environmental performance and social performance is positive and significant related to economic performance, supporting H_{EF} and H_{SF}.

Table 4 provides a synthetic overview of the research hypotheses.

Table4. Research hypotheses

Research hypothesis	Description	Result
H _{1EF}	Internal environmental management –economic performance	Not supported
H _{1EE}	Internal environmental management –environmental performance	Supported
H _{1ES}	Internal environmental management –social performance	Supported
H _{1SF}	Internal social responsible management –economic performance	Not supported
H _{1SE}	Internal social responsible management –environmental performance	Supported
H _{1SS}	Internal social responsible management –social performance	Supported
H _{2MF}	Supplier monitor and assessment –economic performance	Not supported
H _{2ME}	Supplier monitor and assessment –environmental performance	Not supported
H _{2MS}	Supplier monitor and assessment –social performance	Not supported

H _{2CF}	Supplier collaboration –economic performance	Not supported
H _{2CE}	Supplier collaboration –environmental performance	Supported
H _{2CS}	Supplier collaboration – social performance	Not Supported
H _{EF}	Environmental performance –economic performance	Supported
H _{SF}	Social performance–economic performance	Supported

6. Discussion

6.1 Internal sustainable management practices and firm performance

Internal environmental management practices have a positive impact on firm environmental performance. Internal social responsible management practices have a positive influence for firm environmental performance and social performance. The result shows that firms conduct internal sustainable management can effectively enhance firm environmental performance and social performance. This is consistent with the findings of Teixeira et al. (2016), Zhu et al. (2010) and Shradha Ashok Gawankar(2017).Firms carry out the environmental management practices to enhance environmental performance and social responsible management practices to enhance social performance directly. Meanwhile they have cross impact, through environmental management to improve the working conditions of employees, and to enhance product image and corporate reputation, which promote firm social performance. And social responsible management enhances corporate responsibility and awareness of the employee and external communities which have a positive impact on environmental aspects in green procurement and product packaging design, which improve the environmental performance.

The internal environmental management and social responsible management practice has no direct effect on firm economic performance. The adoption of sustainable practices associated with clean energy consumption, waste treatment, waste discharge, employee training and so on, needs large sum of investment at the first stage so it may have no direct impact for firm economic performance which is in line with the result from Brazilian/Indian context or other emerging economy(Chiappetta Jabbour, 2015 and Shradha Ashok Gawankar,2017). While according to RBV, the internal environmental management and social responsible management practice does goods to the valuable resource acquisition and accumulation for the corporate. The government can send the subsidies or other economic incentives and exempt firm from taxes for the promotion of SSCM at the first stage.

6.2 Sustainable supplier management practices and firm performance

Supplier collaboration has a positive impact on firm environmental performance. This suggests that to some extent collaboration could improve firm environmental performance, but only weak support for the result. Through collaboration with suppliers, firms can reduce transaction costs and gain valuable technical resources to have a comparative advantage in the performance environment. Supplier collaboration had no significant direct impact on firm social performance. This may be explained by the current business development process and status. Compared with social responsibility, firms are more concerned about environmental collaboration with suppliers for technology and process improvements.

Supplier monitor and assessment have no significant direct impact on firm performance. Supplier monitor and assessment can be executed by regular supplier visiting, supplier assessment and etc. The purpose is to reduce the supplier risk and is good for supplier development and improvement which will directly affect the supplier behavior and performance. In other words, firms through monitor and

assessment of suppliers directly have an impact on the supplier's performance, but this investment in suppliers not directly affects their firm performance which has also been discussed in Gimenez(2013).Luthra Sunil (2017) argued that the external Supplier monitor and assessment practices can enhance supplier performance which enhances firm performance. And Christian Busse (2016) argued that strategic supplier collaboration is acute for the success of SSCM, and is considered as one of the drivers of SSCM.

6.3 Environmental performance, social performance and economic performance

Both Environmental performance and Social performance have positive impact on economic performance. The conclusion shows that the firms have good environmental and social performance, will enable firms to have more economic benefits. Environmental and social performance level could be regarded as the intangible assets for the firm, which represents a good sense of behavior standard and reputation in the industry. These intangible assets will also promote the customers and public satisfaction which bring the economic benefits to the firm. Based on RBV the firms' accumulation of intangible assets is necessary which enhance the environmental performance and social performance while often ignored by the short-sighted firms (Eduardo Ortas, 2014).

Although the internal environmental management and social responsible management practice has no direct effect on firm economic performance, while by influence environmental performance and social performance which influence economic performance indirectly. It enhance environmental performance and social performance, and then to enhance the economic benefits.

7. Conclusions and future work

7.1 Conclusions and managerial implications

This paper aims to study a variety of environmental and corporate social responsibility practices and the impact on firms' performance from all dimensions.

Based on RBV and TCT, SSCM practices should contribute to firm performance. Through the survey, we analyze the data from 172 Chinese firms, SSCM practices include the four dimensions: internal environmental management practices and social responsibility management practices, external Supplier monitor and assessment and suppliers collaboration which have different impacts on the three dimensions of firm performance: economic performance, environmental performance, and social performance

By strengthening internal environmental management and social responsibility management, Firms can improve environmental performance and social performance; firms working closely with suppliers can promote corporate environmental performance; the continuous improvement of environmental performance and social performance will improve the economic performance ultimately. This paper reveals how SSCM practices influence firm performance. In the long run, SSCM has an important significance for the promotion of economic performance, environmental performance and social performance which constructs the competitive advantages for the firm.

This study has significant managerial implications for Chinese firms and potentially other developing countries. First of all, firms need to understand the potential positive impact that SSCM practices can have on different dimensions of performance consequently and should be more pro-active in their adoption of such practices. Firms should strengthen environmental management such as recycle product design, fewer emission, recyclable packaging materials and the implementation of ISO14001. Also, firms should strengthen social responsibility management such as the employee right protection, healthy and safe working environment for employees, more staff career development opportunities, good social welfare and public welfare, and less or no operations accidents. By these

practices, firms can improve environmental performance and social performance which will improve the economic performance.

Secondly, firms should recognize that enhancing environmental performance and social performance is a process which takes time to accumulate intangible assets, and should not be so anxious. Firms cannot pursue the economic interests while ignoring environmental and social responsibility which will sacrifice its corporate image and reputation. For the sustainable development, firms should strengthen environmental and social responsibility management in the long run which is conducive to their own development and to the natural environment.

Finally, organizations need to be aware that internal SSCM practices and external SSCM practices are integrated. The external SSCM practices may not have direct impact on firm's performance but it will improve the supplier performance and then brings economic benefits to the firm. Strategic supplier collaboration is acute for the success of SSCM.

7.2 Research limitations and future research

This study has some limitations, future research will be improved. Firstly, we studied the four dimensions of SSCM practices about a direct influence on firm performance in three dimensions economic, environmental and social performance. The model didn't not consider the moderator variables and control variables. Future studies of the conceptual model will add new variables into the mechanism of SSCM practices, to further refine the findings. For example, for different industries (such as the food industry and the automotive industry), the impact of SSCM practices to business performance may differ; different stages of development may have different results; Secondly, SSCM were divided into two aspects practices: the internal management and external management. The relationship between the two aspects was not studied. Further analysis of the influences between internal management and external management will be carried out. Finally, in this paper's questionnaire, the collected data only reflected the firms' current situation. The different corporate stages for implementation of SSCM process and the respondent' potential biases in SSCM were never considered in the survey. Future research could consider using time-series data or panel data to explore dynamic change at different SSCM stages. Reducing the respondents' subjective factors and bias and carrying a more comprehensive survey for wider sample will be a future work.

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Appendix A1: Research constructs and variables

Construct	Variables	Items	Adapted from
Internal	Environmental	Eco-design (D1) (D11) Using a life-cycle analysis to evaluate the environmental friendliness of products.	Carter et al. (2000);

Management	Management	(D12) Design of products for choosing less impact on the environment of raw materials	Zhu et al. (2005);	
		(D13) Design of products for reducing the use of raw materials or energy	Wantao Yu et al. (2014)	
		(D14) Design of products for reducing emissions of production processes		
		(D15) Design of products for recycling or reuse.		
		(D16) Design of products for disassembly.		
		(D17) Establishing the recycle system of waste products		
		Sustainable packaging (D2)		
		(D21) Materials healthy in all probable end-of-life scenarios.		
		(D22) Maximizes the use of renewable or recycled source materials.	Dang, Shuo (2016);	
		(D23) Using clean production technologies and best practices.	Zailani et al. (2012)	
		(D24) Packaging meets environmental standards		
		(D25) Eco-labeling of products packaging		
		(D26) Minimize the use of packaging materials		
		Environmental protect Management (D3)		
		(D31) Commitment of production from senior managers.		
		(D32) Support for protection form mid-level managers.		
		(D33) Cross-functional collaboration for environmental improvement.		
		(D34) Promotion and implementation of environmental laws and regulations	Zhu et al. (2005);	
		(D35) Setting environmental protection and environmental monitoring agencies	Zsidisin and Hendrick (1998)	
		(D36) ISO 14001 certification		
		(D37) Regular inspection and maintenance of environmental protection facilities and equipment		
		(D38) Environmental laws and regulations for staff education and publicity to raise environmental awareness		
		Social	Human rights (D4)	
		Responsible Management	(D41) We strictly comply with labor laws, no child labor.	
			(D42) We pay a "living wage" greater than a country's or region's minimum wage.	Carter and Jennings (2002);
			(D43) We provide employees with the safety and occupational health working conditions.	Emmelhainz and Adams (1999)
(D44) We do career planning for staff development.				
(D45) We provide opportunities for continuing education for employees.				
Philanthropy (D5)				
(D51) We often donate to Philanthropic organizations.				
(D52) We often volunteer at local charities.	Carter and Jennings (2002)			
(D53) We support the local educational and cultural development.				
(D54) We promote corporate social responsibility in the industry.				
Safety (D6)				
(D61) We provide customers with safe product.	Carter et al (2002);			
(D62) We ensure the safe, incoming movement of product to our facilities.	Zhu et al. (2005)			
(D63) We ensure our locations are operated in a safe manner.				
External Management	Supplier Monitor and Assessment (E8)			
(E81) We consider environmental and social responsible aspects in supplier selection.				
(E82) We require suppliers to achieve environmental and social responsible certification.				
(E83) We provide the formal request in environmental and social responsible aspects to suppliers.				
(E84) We perform environmental audits for suppliers' internal management systems.	Krause et al. (2000); Carter et al. (2000)			
(E85) We visit our suppliers' plants to ensure that they are not using sweatshop labor, comply with child labor laws.				
(E86) We ask suppliers to pay a "living wage" greater than a country's or region's minimum wage.				
(E87) We ask suppliers to operate in a safe manner and provide safe products.				
(E88) We sent questionnaires of environmental and social responsible aspects to suppliers to monitor their compliance.				

		(E89) The environmental and social responsible aspects relevant assessment results as the basis for rewards and quality improvement.	
	Supplier	(E91) We provide training/education on environmental technology, product quality to suppliers' personnel.	
	Collaboration	(E92) We provide financial support for suppliers update environmental equipment and development of new technologies	
	(E9)	(E93) We participate in the design and development of environmentally friendly products	Krause et al. (2000); Bowen et al. (2001); Claudia Neumüller et al. (2016)
		(E94) We make joint efforts with suppliers to reduce waste.	
		(E95) We provide training/education to suppliers' personnel.	
		(E96) We make joint efforts with suppliers to enhance personnel value and confidence.	
		(E97) We make joint efforts with suppliers to participate philanthropy.	
		(E98) We work together in environmental and social responsible management field to plan, forecast and solve problems.	
Firm	Economic	(F11) Improvement in market share.	De Giovanni and
Performance	Performance	(F12) Improvement in profit.	Esposito Vinzi,
	(F1)	(F13) Reducing environmental damage caused by the accident	2012; Green et al., 2012)
		(F14) Improvement in return on assets.	
		(F15) Improvement in return on sales.	
		(F16) Improvement in return on investment.	
	Environmental	(F21) Reduction in air emission/waste water/solid waste.	
	Performance	(F22) Decrease in consumption of hazardous/harmful/toxic materials.	
	(F2)	(F23) Reduction in energy consumption.	Daily et al. (2007);
		(F24) Decrease in frequency for environmental accidents.	Zhu et al. (2004)
		(F25) Improvement in the compliance to environmental standards.	
		(F26) Improvement in the ability of reuse/recycle.	
		(F28) Improve a firm's environmental situation.	
	Social Perform	(F31) Reduction in the impacts and risks to general public.	Kassinis and
	ance (F3)	(F32) Improvement in occupational health and safety of employees.	Soteriou (2003);
		(F33) Providing more positions in community.	Gimenez et al. (2012)
		(F34) Improvement in product image.	
		(F35) Improvement in firm's image in the eyes of customers.	
		(F36) Improvement in firm's social reputation.	