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An Empirical Inquiry into the Impacts of Sustainable Supply Chain Management on Company Performance

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***A*bstract:** Mounting pressures on business to address the environmental and social consequences of their actions, coupled with increasing reliance on global supply chain networks has led a growing number of Original Equipment Manufacturers to develop global sustainable supply chain management strategies to address a variety of environmental and social sustainability issues. Proponents of the Triple Bottom Line argue sustainability strategies also increase profitability. However, companies resist adopting sustainable supply chain management strategies absent compelling empirical evidence they enhance economic performance. This study empirically tests the impacts of both environmental and social sustainable supply chain management strategies on firm performance. The findings demonstrate these strategies improve firms' environmental, social, and economic performance, including firms' reputations, operating efficiencies, and sales, market shares, and profitability. The results also show that a more supportive regulatory environment increases the positive impacts of sustainable supply change management on firms' economic performance. These findings make a compelling case for the promotion of sustainable supply chain management strategies from both business and public perspectives.

Keywords: Environmental protection; Social responsibility; Supply chain management; SSCM; Sustainability; Triple bottom line

JEL Classifications: L14, M11, M14

1. Introduction

Growing concerns for declining natural resources, climate change, air and water pollution, and toxic wastes; calls for fair treatment of socially disadvantaged groups; and demands for greater corporate transparency (Laszlo and Zhexembayeva, 2011) have put enormous pressures on corporations from governments, non-governmental organizations, academia (Ageron, Gunasekaran, and Spalanzani, 2012; van Marrewijk and Were, 2003; Steger, Ionescu-Somers, and Salzmann, 2007; United Nations Global Compact, 2010), concerned stakeholders, competitors (Svensson, 2009), and from corporate leaders themselves (Larkin, 2006; Laszlo, 2008) to adopt sound sustainability practices.

The philosophical and ethical foundations for addressing environmental and social sustainability were developed by Brundtland and the World Commission on Environment and Development (WCED, 1987) from the fundamental principle that today's needs should be addressed without compromising the needs of future generations. Elkington (1997) subsequently developed the triple bottom line (TBL) approach to sustainability that requires firms to pursue balanced strategies for achieving environmental, social, and economic goals.

The challenges companies face implementing TBL were magnified by the 2008 Ruggie Report, issued under the auspices of the United Nations, emphasizing that suppliers have the same "responsibility to respect" human rights as original equipment manufacturers (OEMs), and that both share the responsibility for their collective impacts on human rights (United Nations Global Compact, 2010). Coupled with increasing OEM reliance on global supply chain networks (Christopher, Mena, Khan, and Yurt, 2011; Lai, Harjati, McGinnis, Zhou, and Guldberg, 2008; Zhu, Sarkis, and Lai, 2008) the TBL approach to sustainability has, for many companies, become the TBL approach to Sustainable Supply Chain Management. Focal companies in the supply chain, often OEMs (Seuring, 2008), were now responsible for developing, implementing, and monitoring comprehensive SSCM strategies throughout their supply chains to achieve environmental and social as well as economic goals (Carter and Rogers, 2008; Morali and Searcy, 2013).

2. Purpose

Advocates urging companies to adopt the TBL approach to sustainability argue it creates strategic opportunities (Rao and Holt, 2005), is a source of long-term competitive advantage (Shi, Koh, Baldwin, and Cucchiella, 2012), and leads to favorable financial performance (Shi *et al*., 2012). These arguments are supported by numerous theories detailing the potential benefits of TBL from the social sciences and strategic management disciplines (Carter and Rogers, 2008). They include the new development paradigm, focused on the environmental, social, and economic impacts of multinational companies (Dunning and Fortanier, 2007), the base of the pyramid, focused on social exclusion and impoverished communities (Hall and Matos, 2010; Prahalal and Hart, 2002**),** resource dependence theory, focused on interdependencies among companies **(**Pfeffer and Salancik, 1978), the resource-based view of the firm, focused on the contributions of resources to competitive advantage (Priem and Swink, 2012; Ramsay, 2001), and the resource advantage theory emphasizing how social systems contribute to competitive advantage (Hunt and Arnett, 2003).

While there exists substantial theoretical support for the TBL approach to SSCM, companies have been reticent to adopt this approach to sustainability in the absence of compelling empirical evidence it contributes to profitability, which is more frequently asserted than demonstrated. The result is that, with few exceptions, (e.g., Laszlo and Zhexembayeva, 2011; Ford, 2013; Hewlett-Packard, 2013) the business world has not enthusiastically embraced the TBL approach to SSCM. The question is: Can the TBL approach to SSCM become a viable concept without compelling empirical evidence it contributes to economic as well as to environmental and social goals.

The purpose of this study is to test the empirical impacts of the TBL approach to SSCM on the environmental, social, and economic performance of focal companies responsible for formulating and implementing SSCM strategies throughout their supply chains. Evidence it contributes to all three dimensions of TBL would provide much needed support for the adoption of the TBL approach to SSCM by the business community (Friedman, 1970; Shi *et al*., 2012; Wang and Sarkis, 2013; Wolf, 2014) and validate it as an effective public policy for addressing social and environmental issues. This study also assesses the moderating effects company size, industry collaboration, and regulatory frameworks have on the impacts the TBL approach to SSCM has on the performance of focal companies.

3. Methodology

Multiple regression in Minitab 17 was used to test SSCM's impacts on the firm's environmental, social, and economic performance; hierarchical multiple regression to assess the moderating effects company size, industry collaboration, and regulatory framework have on these impacts. Statistical significance required p values less than .05. The psychometric properties of the SSCM and performance constructs were evaluated using Cronbach's coefficient alpha test of reliability (Cronbach, 1951), and the AVE test of convergent validity (Chin, Gopal, and Salisbury, 1997; McLure, Wasko and Faraj, 2005; Wixom and Watson, 2001).

4. The Survey Instrument

Data were collected using an online survey designed specifically for this study. The survey used a five-point Likert-scale - 5 Great Extent, 4 Considerable Extent, 3 Moderate Extent, 2 Some Extent, 1 Not at All - to assess companies' engagement in SSCM, and the effects SSCM has on their environmental, social, and economic performance. The survey included 46 questions distributed as follows: four questions on company demographics, four on environmental and five on social sustainability strategies, nine each on environmental and social performance, six on economic performance (two each on operational, reputational, and financial performance), five on company size, and two each on industry collaboration and the regulatory framework.

5. The Sample

The survey was sent to 410 business professionals engaged primarily with sustainability, supply-chain management, and corporate strategy in global organizations that managed large, complex, multi-national supply chains. Total responses numbered 242, varying from 195 to 242 for individual questions.

The sample includes participants from privately held (53%), publicly traded (40%), and mixed-ownership (7%) companies operating in the automotive, electronics, telecommunications, and aerospace industries, with 60% of participants from the automotive industry. Nearly 90% of the companies operate within NAFTA, which limits variability in the external environments and regulatory frameworks. Over 50% of the respondents reported their companies had 10,000 or more employees in 2013; nearly 50% had worldwide sales of five billion US dollars or more. Almost 42% of the companies had over 1,000 suppliers, and close to 60% had over 250 suppliers in 2013. Almost 62% of the companies had suppliers located in ten or more countries. The complexity of the respondents' supply chains was also assessed by their longest logistical distance (LLD), measured by the number of intermediate suppliers between the company and its source of raw materials. Over 50% of the respondents reported at least 4 intermediate suppliers between their company and its source of raw materials, 15% reported a LLD of 10 or more. High LLD numbers increase the complexity of managing supply chains because it is more difficult for focal companies to coordinate SSCM strategies with tier two, three, and smaller suppliers with which they do not deal directly.

Finally, nearly 60% of the companies in this study issued an annual environmental and/or social sustainability report, 90% of which addressed both environmental and social issues. Thus, the companies in this study are large organizations with substantial resources that are concerned with both environmental and social issues, and tasked with implementing, under great external scrutiny, the TBL approach to SSCM throughout large, complex, global supply chain networks.

6. The Model

As the dynamics shown in Figure 1, environmental and social sustainability strategies in supply chain management affect company environmental, social, and economic performance.

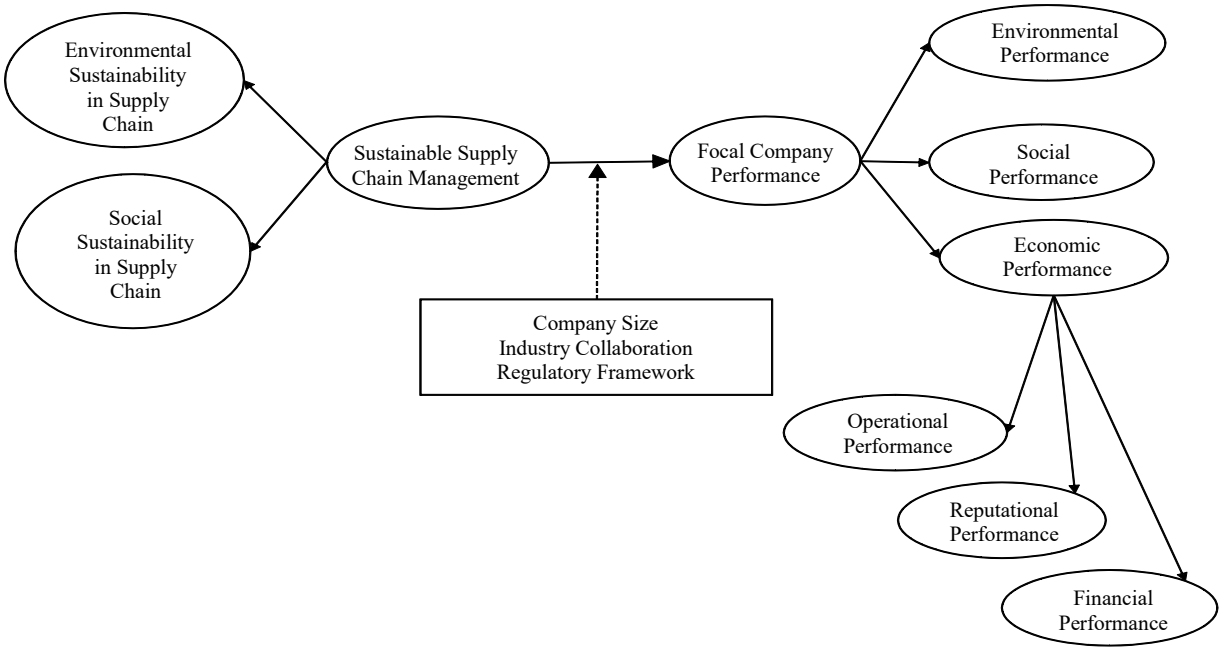

Figure 1. Conceptual model of SSCM's impacts on focal company performance.
Original figure developed by authors for this study.

Economic performance includes operational, reputational, and financial performance. Environmental sustainability includes SSCM strategies to minimize negative impacts on the environment, including deforestation, air and water quality, toxic waste, and resource depletion (Wang and Sarkis, 2013). It is measured in this study by the extent to which the focal company establishes environmental standards for air pollution, water usage, deforestation, and climate change for its suppliers; monitors supplier performance; rewards (bonuses, preferences, increased business) suppliers for meeting or exceeding these standards: and the extent to which it requires its suppliers to cascade its standards downstream to their suppliers.

The social sustainability dimension of SSCM includes strategies to improve the safety, health, and well-being of communities and peoples affected by the company's actions. It is measured by the extent to which the focal company encourages its suppliers to recruit persons from under-represented, vulnerable, or under-privileged social groups (e.g., minorities, women, persons with disabilities); sets standards for its suppliers for hiring practices, fair wages, working conditions, and community involvement; monitors supplier performance against these standards; rewards suppliers for meeting or exceeding them; and requires its suppliers to cascade these standards to downstream suppliers.

Focal company performance is assessed against the three dimensions of TBL – environmental, social, and economic performance. Throughout the study, company performance refers to the company's composite performance on the three dimensions of TBL. The impacts of SSCM on the company's environmental performance are measured by the ratings of five professional watch groups: Calvert Social Index, Corporate Responsibility Officer, Ethisphere, Dow Jones Sustainability Index, and The Carbon Disclosure Project. The impacts of SSCM on the focal

company's social performance are measured by its social responsibility ratings on the Calvert Social Index, Corporate Responsibility Officer, Ethisphere, Dow Jones Sustainability Index, and FTSE 4 Good.

The impacts of SSCM on the focal company's economic performance are measured by its impacts on the firm's operations, reputation, and finances. SSCM is expected to enhance operational performance by improving on-time delivery, speed to market, product quality, and cost efficiency (Zhu *et al*., 2012; Golicic and Smith, 2013).

SSCM, often associated with 'doing good,' affects the reputation of the focal company by enhancing its ". . . brand attributes and value leading to greater customer's attraction, retention and trust, and new marketing opportunities" (Mason and Simmons, 2014, p. 820). The impacts of SSCM on reputational performance are measured by enhanced company image, more effective marketing/advertising, and better relationships with external constituencies.

Proponents of TBL argue that SSCM improves financial performance (Thornton, Autry, and Glicor, 2013), and stock prices (Delmas, Etzion, and Nairn-Birch, 2013). The impacts of SSCM on financial performance here are measured by increased sales and market share, lower costs, and higher profitability (Wang and Sarkis, 2013).

The impacts of SSCM on company performance might be moderated by company size, collaboration, and the regulatory framework. The size of the focal company, measured by total sales revenue, affects its ability to implement SSCM strategies throughout the supply chain (Tate, Ellram, and Kirchoff, 2010). Larger firms have greater resources for pursuing SSCM, and, being the main target of scrutiny by proponents of TBL, are more inclined to engage in SSCM (Fombrun and Shanley, 1990).

Collaboration among companies on SSCM includes training, audit and certification programs, and the use of standardized compliance tools that lower costs (Golicic and Smith, 2013). This study measures the level of collaboration on SSCM by the amount of collaboration on these programs among the focal companies, its suppliers, industry organizations, and trade associations.

SSCM supported by a legal mandate is less likely to put the focal company at a competitive disadvantage, while encouraging suppliers to participate in the SSCM program (Liu, Yang, Qu, Wang, Shishime and Bao, 2012). The regulatory framework is measured by the extent to which regulatory requirements drive and support the focal company's environmental and social sustainability policies and practices throughout the supply chain.

7. Results

7.1 Reliability, internal consistency, and construct validity

Reliability was evaluated by Cronbach's alpha test for internal consistency (Cronbach, 1951) for the SSCM and performance constructs in Tables 1 and 2. Alpha scores of .953 for SSCM, .and 911 and .914 for the environmental and social sustainability sub-constructs all indicate excellent reliability. The alpha scores for company performance (.96) and economic performance (.93) in Table 2 indicate excellent reliability; scores of .85 for environmental, and .87 for social performance indicate good reliability. Alpha scores for the three dimensions of economic performance also showed good reliability, i.e., .88 for operational performance, .81 for reputational, and .89 for financial performance. Construct validity for the SSCM and performance constructs in Tables 1 and 2 was evaluated by convergent validity using average variance extracted (AVE), which should have a value greater than .50 (Chin, Gopal, and Salisbury, 1997; McLure, Wasko and Faraj, 2005; Wixom and Watson, 2001). AVEs for the environmental and social sustainability

dimensions of SSCM, and for environmental, social, and the three dimensions of economic performance were all greater than 0.50.

Table 1. Reliabity of the sustainable supply chain management (SSCM) constructs

SSCM	Mean	SD	Alpha	Ave.
SSCM (13-items)	3.28	1.06	.953	
Environmental Sustainability (6 items)	3.24	1.13	.911	.663
Extent of collaboration to address ES	3.61	1.33		
Extent of monitoring suppliers' performance for ES	3.31	1.32		
Extent of setting standards for ES	3.25	1.41		
Extent of rewarding suppliers for ES	2.45	1.30		
Extent of requiring cascading of ES Standards	2.86	1.34		
Extent of legal/regulatory influence on ES	3.88	1.26		
Social Sustainability (7 items)	3.31	1.07	.914	.618
Extent of collaboration to address SS	3.61	1.32		
Extent of monitoring performance for SS	3.30	1.33		
Extent of setting standards on SS	3.34	1.35		
Extent of rewarding social performance	2.48	1.30		
Extent of requiring cascading of SS standards	2.92	1.38		
Extent of legal/regulatory influence on SS	3.80	1.24		
Extent of recruiting from disadvantaged groups	3.61	1.33		

Table 2. Reliability of performance constructs

Company Performance	Mean	SD	Alpha	Ave.
Firm Performance (10 items)	3.21	1.10	.96	
Environmental Performance	3.25	1.24	.85	.735
Extent of influence by SC ES policy/practice	3.35	1.30		
Extent of influence by SC SS policy/practice	3.16	1.34		
Social Performance	3.27	1.18	.87	.765
Extent of influence by SC ES policy/practice	3.20	1.27		
Extent of influence by SC SS policy/practice	3.35	1.24		
Economic Performance	3.18	1.12	.93	
Operational Performance	3.00	1.26	.88	.780
Extent of influence by SC ES policy/practice	3.06	1.33		
Extent of influence by SC SS policy/practice	2.96	1.34		
Reputational Performance	3.51	1.12	.81	.657
Extent of influence by SC ES policy/practice	3.54	1.21		
Extent of influence by SC SS policy/practice	3.48	1.23		
Financial Performance	3.02	1.24	.89	.792
Extent of influence by SC ES policy/practice	3.06	1.30		
Extent of influence by SC ES policy/practice	3.00	1.30		

7.2 SSCM Impacts on Company Performance

Table 3 shows SSCM has statistically significant ($p < .01$) positive effects on company performance; on its three components - environmental, social, and economic performance; and on the three dimensions of economic performance – operational, reputational, and financial.

Table 3. Impacts of SSCM on Company Performance

	Coef	SE Coef	*t*-value	*p*-value
PE				
Constant	0.444	0.137	3.24	.00
SSCM	0.846	0.039	21.29	.00
EnP				
Constant	0.181	0.160	1.13	.26
SSCM	0.936	0.046	20.06	.00
SoP				
Constant	0.353	0.154	2.29	.02
SSCM	0.891	0.044	19.93	.00
EcP				
Constant	0.559	0.157	3.57	.00
SSCM	0.801	0.045	17.58	.00
OpP				
Constant	0.401	0.204	1.97	.05
SSCM	0.798	0.059	13.46	.00
FiP				
Constant	0.486	0.202	2.41	.01
SSCM	0.755	0.058	13.21	.00
ReP				
Constant	0.790	0.150	5.27	.00
SSCM	0.830	0.043	19.02	.00

***Note*:** PE = Performance; EnP = Environmental Performance; SoP = Social Performance; EcP = Economic Performance; OpP = Operational Performance; FiP = Financial Performance; ReP = Reputational Performance.

Table 4 shows that both dimensions of SSCM, environmental and social sustainability, have significant ($p < .01$) positive effects on company performance. The VIFs of 4.33 for both environmental and social sustainability indicate moderate multicollinearity.

Table 4. Impacts of environmental and social sustainability on company performance

	Coef	SE Coef	*t*-value	*p*-value	VIF
Constant	0.47	0.14	3.37	.00	
ES	0.44	0.08	5.55	.00	4.33
SS	0.40	0.08	4.84	.00	4.33

***Note*:** ES = Environmental Sustainability; SS = Social Sustainability.

As shown in Table 5 on next page, environmental sustainability has statistically significant positive effects on all three legs of TBL, and on all three dimensions of economic performance.

Table 5. Impacts of environmental sustainability on environmental, social, and economic performance

	Coef	SE Coef	*t*-value	*p*-value	VIF
EnP					
Constant	0.47	0.15	2.88	.00	
ES	0.86	0.04	19.13	.00	1
SoP					
Constant	0.75	0.16	4.69	.00	
ES	0.77	0.04	16.57	.00	1
EcP					
Constant	0.79	0.15	5.26	.00	
ES	0.73	0.04	16.78	.00	1
OpP					
Constant	0.6	0.19	3.16	.00	
ES	0.74	0.05	13.24	.00	1
FiP					
Constant	0.71	0.19	3.71	.00	
ES	0.71	0.05	12.75	.00	1
ReP					
Constant	1.05	0.14	7.19	.00	
ES	0.75	0.04	17.59	.00	1

***Note*:** EnP = Environmental Performance; SoP = Social Performance; EcP = Economic Performance; OpP = Operational Performance; FiP = Financial Performance; ReP = Reputational Performance; ES = Environmental Sustainability in Tables 5 and 6.

Table 6. Impacts of social sustainability on environmental, social, and economic performance

	Coef	SE Coef	*t*-value	*p*-value	VIF
EnP					
Constant	0.32	0.17	1.88	.06	
SS	0.88	0.05	17.64	.00	1
SoP					
Constant	0.35	0.15	2.28	.02	
SS	0.88	0.04	19.86	.00	1
EcP					
Constant	0.68	0.16	4.09	.00	
SS	0.75	0.04	15.75	.00	1
OpP					
Constant	0.55	0.21	2.6	.01	
SS	0.74	0.06	12.09	.00	1
FiP					
Constant	0.6	0.2	2.91	.00	
SS	0.73	0.06	12.1	.00	1
ReP					
Constant	0.88	0.15	5.56	.00	
SS	0.79	0.04	17.44	.00	1

Social sustainability, illustrated in Table 6, also has statistically significant positive effects on environmental, social, and economic performance, and all three dimensions of economic performance.

These findings provide substantial, and much needed empirical evidence that SSCM contributes to all three legs of the TBL.

7.3 Moderation

The moderating effects size, collaboration, and regulatory frameworks have on the impacts SSCM has on focal company performance are shown in Table 7.

Table 7. Moderating effects of size, collaboration, and the regulatory framework on the impacts of SSCM on performance

Variables	Coef	SE Coef	*t*-value	*p*-value	VIF
Constant	0.24	0.27	0.90	.37	
SSCM	0.94	0.09	11.10	.00	4.55
Size	0.06	0.09	0.70	.48	10.73
SSCM*Size	-0.03	0.03	-1.15	.25	17.08
Constant	0.13	0.35	0.37	.72	
SSCM	1.00	0.15	6.78	.00	13.46
Collab.	0.08	0.11	0.71	.48	11.31
SSCM* Collab.	-0.04	0.04	-1.02	.31	34.89
Constant	1.12	0.36	3.12	.00	
SSCM	0.56	0.15	3.77	.00	13.92
Reg. Frame.	-0.18	0.10	-1.86	.06	7.73
SSCM*Reg. Frame.	0.07	0.03	2.09	.04	30.33

***Note*:** SSCM = Sustainable Supply Chain Management; Size = Company size measured as total sales revenues; Collab = Collaboration on sustainability issues; Reg. Frame. = Regulatory Framework.

The regulatory framework significantly moderates the impacts SSCM has on performance (p = .04). Company size, measured by total sales, and collaboration have negative but not statistically significant moderating effects on the impacts SSCM has on performance (p values = .25 and 31). The very high VIFs indicating substantial multicollinearity between the independent variables and the moderating variable are to be expected, and do not invalidate the moderation effects (Disatnik and Sivan, 2016). The moderate to high VIFs (4.55 to 13.92) among the independent variables do create multicollinearity problems that affect the certainty and stability of the coefficient estimates, and thus the reliability of the individual predictor variables.

8. Concluding Remarks

The findings in this study provide substantial and much needed empirical evidence that SSCM and both its dimensions, environmental and social sustainability, have statistically significant, positive impacts on the focal company's performance; on all three legs of TBL – environmental, social, and economic performance; and on all three dimensions of economic performance - operational, reputational, and financial. The study also found that the stringency of the regulatory framework moderates the impacts of SSCM on performance, but company size and collaboration do not.

8.1 Implications

These empirical findings have several important implications for practitioners, policy makers, and proponents of the TBL approach to SSCM. The most important is that the statistically significant positive effects of the TBL approach to SSCM on environmental, social and economic, and all three dimensions of economic, performance, make a compelling case for the TBL approach to SSCM from both a business and public policy perspective.

The finding that the regulatory framework has a statistically significant positive moderating effect on the impact of the TBL approach to SSCM on performance suggests OEMs work more closely with policy makers to fashion regulatory frameworks that support effective SSCM policies and practices. Companies should work with policy makers to craft regulatory frameworks that provide greater certainty, less risk, utilize market incentives to reward innovation, minimize differential competitive effects among OEMs and suppliers, and support efforts to promote SSCM throughout the supply chain (Rotter *et al*., 2014). Companies should also promote international cooperation among regulatory agencies to facilitate cascading SSCM throughout global supply chain networks.

The finding that company size, measured by total sales, does not moderate the impacts of SSCM on performance suggests the environmental, social, and economic benefits of the TBL approach to SSCM are available to smaller firms as argued by Golicic and Smith, "…any size firm should be able to achieve similar positive results from environmental supply chain practices…" (2013, p. 81).

8.2 Future research

This study focuses on how SSCM affects focal company performance. Future studies that test how SSCM affects the performance of tier 1, 2, and smaller suppliers are needed to demonstrate the advantages of cascading SSCM throughout the entire supply chain.

Future research that explores the performance effects of specific SSCM policies and practices, such as the use of SSCM metrics in supplier scorecards, would identify the most effective instruments for implementing SSCM throughout the supply chain (Govindan *et al*., 2014). Studies that explore the effects of SSCM policies and practices on specific environmental and social issues would enable companies to better align SSCM strategies with specific environmental and social goals.

This study explored the moderating effects company size, collaboration, and regulatory frameworks have on the impacts SSCM has on focal company performance. Other studies have explored the impacts of the economy on SSCM, and found that SSCM wanes during economic slowdowns (Brandenburg, 2016). It is therefore important to understand how the macroeconomic environment impacts (moderates) the effects of SSCM on environmental, social, and economic performance during periods of negative, low, moderate, and high economic growth. Such analyses could help policy makers and companies adapt SSCM strategies to the exigencies of the external environment.

Finally, research that documents the characteristics and effectiveness of the TBL approach to SSCM in countries with different environmental and social priorities, regulatory frameworks, and economic systems is essential to effectively cascading SSCM throughout increasingly global supply chain networks (Parmigiani and Rivera-Santos, 2015). Such studies would also contribute to developing integrated international regulatory requirements that maximize the positive impacts of the TBL approach to SSCM on environmental, social, and economic goals.

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