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Sustainable supply chain management: the role of supply chain management investments and global sourcing

by

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Sustainable supply chain management: the role of supply chain management investments and global sourcing

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Abstract

Sustainability, intended as including in companies' strategies and practices environmental and social aspects, is an always more relevant topic. In this paper we specifically address how three variables, namely "sustainable" supply chain management (SSCM), "traditional" supply chain management (SCM) and global sourcing interact each other to determine higher or lower sustainability performance. We assessed these relationships on the base of the fifth edition of the International Manufacturing Strategy Survey (IMSS), based on a sample of more than 400 companies. Our results show that the implementation of SSCM is positively associated with higher performance levels, but also that a fundamental contribution comes from SCM. Next, companies that have many global suppliers, despite the difficulties, can achieve comparable performance than competitors with local suppliers, but they have to rely much more on SSCM. These findings significantly expand literature thresholds and shed some further light on the sustainability phenomenon.

Keywords

Sustainability, Sustainable Supply Chain Management, Supply chain Management, global sourcing, survey

1. Introduction

Sustainability is a key issue of governments and companies agendas and, nowadays, growing attention is paid on environmental and social dimensions of the triple bottom line (Elkington, 1998). A critical aspect that regards the sustainability phenomenon is the adoption of environmental and social programs by companies. Firms can rely on both internal programs (i.e., corporate social responsibility initiatives such as environmental management systems, ISO certifications and philanthropy) and external initiatives (i.e., sustainable supply chain management programs such as monitoring supplier sustainability and develop new sustainable products and processes) that should be triggered and sustained by organization capabilities (Ateş et al., 2011; Gavronski et al., 2011).

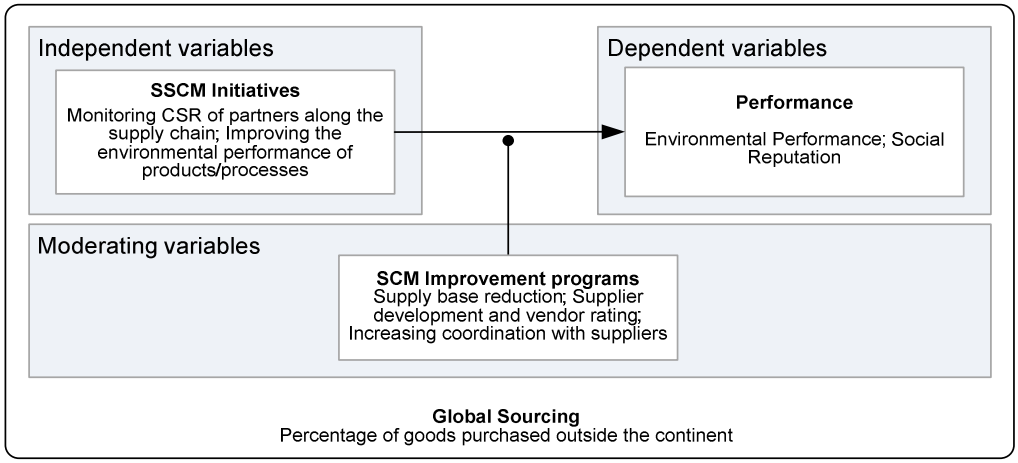
Despite the history of sustainability literature (Seuring and Muller, 2008), a first lacking point regards the relative importance of such programs to the achievement of superior environmental and social performance. Indeed, although internal and external investments can be taken off jointly (Ateş et al., 2011) or subsequently (Gavronski et al., 2011), one should wonder which of the two exerts greater impact on companies' sustainability.

A second important aspect relates to capabilities that companies should demonstrate to effectively develop sustainability initiatives. Specifically, according to former literature (Bowen et al., 2001), supply chain management (SCM) investments seem to be critical for the effective deployment of external programs such as sustainable supply chain management initiatives (SSCM). However, previous contributions demonstrated this relationship mainly from the environmental side of sustainability, while the social side seems to be neglected (Seuring and Muller, 2008).

Another under investigated point is the impact of global sourcing. Supply chain are obviously not all identical, and the level of supply networks globalization can play an important role in regards of sustainability. From one side, global sourcing can make more difficult the execution of SSCM practices (e.g. monitoring suppliers' environmental impacts), but from the other side global sourcing can make SSCM necessary. Indeed, when suppliers are domestic, there is much less need of formally monitoring their practices or set specific cooperation mechanisms.

Trying to reduce these gaps, this paper empirically evaluates the relationships among companies' environmental and social performance and three kinds of variables: SSCM initiatives implemented by organizations, companies' SCM improvements programs and global sourcing strategies. In doing this, we also control for internal sustainability programs by companies. Figure 1 synthesizes our research model

Figure 1 – Research framework



According to our framework, SSCM initiatives contribute to companies' environmental and social performance. Moreover, this direct relationship could be moderated by SCM improvement programs and global sourcing.

We argue our study makes at least four important contributions: First, we consider the impact of different environmental and social programs simultaneously, addressing a relevant gap in supply chain literature (e.g., Seuring and Muller, 2008). Second, we are interested in the impact of such programs on both environmental and social dimensions of sustainability. Recently, Pullman et al. (2009) pointed out that "although a growing body of supply chain literature has examined environmental sustainability programs, there has been little research to expand sustainability considerations to social issues" (p.48). Third, we analyze internal programs, SSCM initiatives, SCM investments and the role played by global sourcing. To the best of our knowledge, supply chain literature lacks of studies that simultaneously analyze the impact of such variables on companies sustainability performance. Finally, following literature's recommendation (Pagell and Gobeli, 2009), we conduct research on sustainability at the operational level by examining individual plants instead of companies. Specifically, we test our conceptual framework on the base of the fifth edition of the International Manufacturing Strategy Survey (IMSS), based on a sample of more than 400 plants locating around the world.

The remainder of the paper is organized as follows: first we discuss the existing literature and, based on research gaps, we state our research propositions. Next we explain in detail the sample and the methodology. After that, we show the results. Finally, we discuss the results and provide conclusions of this work.

2. Research background and propositions development

2.1 Triggers and programs for environmental and social sustainability

Sustainability is a term that seemingly has multiple definitions because it is used for many purposes (Dryzek, 1997). For our purpose a sustainable business is one that aims at continuously reducing its environmental and social impacts, assuring the possibility for future generations to meet their needs. This implies that the organization does not net harm to natural capital: if the business process requires the use of natural resources faster than that resources can be replaced, sooner or later it will have to stop. According to this, environmental and social performance will be the focus of this research while the economic dimension, although crucial for the companies' survival, will not be considered.

Today's industrial companies are increasingly scrutinized by external stakeholders (i.e., governments, customers, NGOs) that seek for sustainable products and production processes. Recent studies identify external pressures from various stakeholders (e.g., government and customers) as important triggers for the implementation of sustainable practices by industrial companies (Carter, 2004; Ehrgott et al., 2011; Seuring and Müller, 2008). The answer to the question "why environmental and social programs should be implemented" is also influenced by existing pressures from internal stakeholders (e.g., top management, middle management and employees). Previous contributions (e.g., Aragon-Correa and Sharma, 2003; Ateş et al., 2011; Bowen et al., 2001; Carter and Jennings, 2004; Gavronski et al., 2011; Lambert et al., 1998) point out that organizations' commitment to go beyond basic compliance with environmental and social regulations (i.e., corporate proactivity) represents an important antecedents to the development of effective sustainability programs.

Thus, companies have been improving their environmental and social footprint both internally (i.e. in their organizations) and in their supply chains. To this purpose, companies should rely on internal investments such as ISO 14001 (Sarkis, 2001), internal environmental management practices (Zhu et al., 2007), environmental management systems (EMS) (Klassen and Whybark, 1999), and initiatives to improve employees' health and safety (e.g., OHSAS18001) as well as corporate social reputation (Gavronski et al., 2011; Pullman et al., 2009). Furthermore, attention should be paid to sustainable supply chain management. SSCM is defined by Carter and Rogers (2008) as "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systematic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chain". According to Seuring

and Muller (2008), companies willing to improve their environmental and social performance and the ons of their suppliers should combine two complementary SSCM approaches: suppliers' monitoring and life cycle analysis (LCA).

On one hand, companies should evaluate the level of corporate social responsibility (CSR) of their suppliers and develop value-added relationships with those suppliers that show good performance in terms of workplace safety, working conditions, harmful emissions and energy efficiency. In this respect, the integration of management systems, such as ISO 14001, OHSAS 18001 and SA 8000 in the scorecard of suppliers' selection criteria can ensure that environmental and social sustainability is managed properly throughout the supply chain (Corbett and Kirsch, 2001; Nawrocka et al., 2009; Stigzelius and Mark-Herbert, 2009).

On the other hand, firms should proactively implement LCA or other similar analyses (e.g., design for maintenance, design for environment, design for recycling) involving external stakeholders (i.e., suppliers). Such initiatives allow companies to develop new products and processes in a more environmentally and socially responsible way, going beyond basic compliance with regulations (Lamming and Hampson, 1996; Seuring, 2004).

2.2 SSCM and companies' environmental and social performance

SSCM initiatives can firstly allow to improve supplier's sustainability performance. For instance, empirical evidences have showed how suppliers' environmental and social commitment is positively related to the definition of minimum performance requirements by its major customer (Jiang, 2008; Roberts, 2003; Simpson et al., 2007).

On the other side, it was demonstrated that environmental programs toward suppliers can also directly affect the environmental performance of the focal firm (Ateş et al., 2011; Theyel, 2001). Indeed, SSCM programs may take a form of joint problem-solving sessions, information sharing, establishing common goals, personnel and equipment sharing with suppliers. For instance, environmental collaborations includes the exchange of critical information and requires a mutual willingness to learn about each other's operations in order to plan and set goals for environmental improvements. It also implies cooperation to reduce the environmental impact associated with material flows in the supply chain. Finally, environmental collaborations comprises a good understanding of each other responsibilities and capabilities in regard to environmental management. These elements in turn can lead to inter-organizational learning and consequently contribute to the environmental performance of the company (Ateş et al., 2011; Zhu et al., 2007). Additionally, it was demonstrated that the adoption of a new production process that generates less pollution (and that, for instance, can

result from the fruitful collaboration with suppliers) improves the working conditions for the focal company's employees (Elkington, 1994). Conversely, improvements of employees welfare can sometimes be linked to the reduction of potentially damaging environmental actions (Marshall et al., 2005).

Accordingly, we can state that SSCM should positively influence the companies achievement of higher environmental and social performance, thus our first research proposition:

RP1. There is a positive relationship between the extent to which firm invests in SSCM initiatives and the company achievement of higher environmental and social performance.

2.3 SCM, global sourcing and the effectiveness of SSCM initiatives

SSCM initiatives can be difficult to develop and sometimes don't lead to the achievement of the desired goals (e.g., Jiang, 2009). In literature two causes have been identified for this: lack of collaborative relationships inside the supply chain and global spread of suppliers all over the world (Roberts, 2003).

Starting from the first point, approaches like LCA should be developed by involving supply chain partners to better understand all design decisions' consequences and exhaustively evaluate any possible environmental and social improvements of products and processes (Fava, 1997; Lamming and Hampson, 1996; Seuring, 2004). Involving suppliers into sustainable development programs however can be difficult if suppliers are not interested and committed to sustainability. Furthermore, collaboration with suppliers can be unfruitful when there is a lack of integration among partners or when procedures are not formally defined and coordination mechanisms are missing (Seuring, 2004; Simpson et al., 2007). Consistently, Bowen et al. (2001) pointed out that companies should avoid complex green initiatives (i.e., environmental data gathering about products, processes or vendors, and joint development of new environmental product or processes) when they do not have the capabilities to implement them. From this standpoint (Bowen et al., 2001; Vachon and Klassen, 2006), companies' supply management capabilities such as intra-firm collaboration, partnering approaches, technical skills of purchasing personnel and detailed supply policies are seen as pre-conditions for successful environmental initiatives with supply chain. The presence of these antecedents affects the extent to which firms engage in SSCM initiatives (Sharfman et al., 2009). Furthermore, logistical integration, technological integration and supply base concentration affect both the prevalence and the effectiveness of green supply practices (Vachon and Klassen, 2008).

According to contributions discussed above, SCM improvements programs made by companies to enhance supply chain visibility and coordination, can represent for companies a fertile ground for the development of SSCM initiatives and the achievement of high environmental and social performance. In particular, three categories of SCM improvement programs have been identified as potentially supportive for SSCM initiatives.

A. Investments in restructuring supply strategy and the organization and management of supplier portfolio through e.g. supply base reduction. A trend in supply management is to move toward delegation of responsibilities to supplier and supply base reduction. A strategic supply focus will allow the organization to consider a small range of strategic relationships with suppliers (Cousins, 1999; Lamming, 1993). Such focus facilitates closer cooperation with suppliers and allows to share key resources, technologies, risks and rewards, motivating suppliers to work toward environmental and social sustainability (Bowen et al., 2001; Roberts, 2003).

B. Implementing supplier development and vendor rating programs. According to Bowen et al. (2001), firms that already have existing vendor assessment and development (Noci, 1997), are good at formal approaches to the selection and empowerment of suppliers (Choi and Hartley, 1996; Krause et al., 2007), have clear guidance on how environmental and social issues may be balanced with potential increased cost and possess suitable performance measures (de Boer et al., 2001; Wu and Pagell, 2011) may be expected to find easier to manage SSCM initiatives.

C. Increasing the level of coordination of planning decisions and flow of goods with suppliers including dedicated investments. Adopting cooperative customer-supplier relationships may enhance the firm's ability to manage environmental issues more effectively. For example, it facilitates communication and the transfer of relevant and private information between the firm and its suppliers and builds confidence within inter-organizational relationships to aid in the implementation of environmental change (Lamming and Hampson, 1996).

Accordingly, SCM improvement programs crucially define the status-quo of what is feasible for individual firms when intending to properly manage SSCM initiatives. Thus these three categories of SCM investments may positively influence the achievement of high environmental and social performance. Therefore our second research question is:

RP2. There is a positive moderation effect of SCM improvement programs on the direct relationship between SSCM initiatives and company's sustainability performance.

Then, as mentioned before, a second factor that can hamper the success of SSCM practices is global spread of suppliers. As recent studies report, global sourcing (i.e. purchases outside the continent where the company is based) is an always more diffused practice (Cagliano et al., 2008; Trent and Monczka, 2003) even if this can negatively affect sustainability. When selecting suppliers from abroad, in fact, lower procurement cost is usually considered the most important driver (Bozarth et al., 1998; Frear et al., 1992; Trent and Monczka, 2003; Womack and Jones, 1996) while sustainability related factors are less considered (Mamic, 2005). Moreover, controlling suppliers that are far away is practically more difficult and dealing with different cultures can diminish the effectiveness of joint investments in SSCM or of transferring/absorbing sustainable best practices to/from suppliers (Pagell et al., 2005). Finally, suppliers in developing countries might be not as interested to sustainable initiatives as their customers in developed ones. Thus, our third research proposition is:

RP3. There is a negative moderation effect of global sourcing on the direct relationship between SSCM initiatives and company's sustainability performance.

On the other side, companies intensively adopting global sourcing deal with more complex supply chains (e.g. new and more suppliers, variable exchange rates, changing local policies) so they are pushed to adopt SCM improvement programs. Geographical distances not only increase transportation costs, but complicate decisions because of inventory cost tradeoffs due to increased lead-time in the supply chain (Dornier et al., 2008; MacCarthy and Atthirawong, 2003). Similarly, infrastructural deficiencies in developing countries (e.g., transportation and telecommunications, inadequate worker skills, supplier availability, supplier quality) provide challenges normally not experienced in developed countries (Meixell and Gargeya, 2005). Furthermore, global SCs carry specific risks such as variability and uncertainty in currency exchange rates, economic and political instability, and changes in the regulatory environment (Carter and Vickery, 1988, 1989; Dornier et al., 2008). Because of that, it has been found in literature that companies tend invest both in global sourcing and in SCM. Therefore, if the research proposition 2 is verified, we should find also that:

RP4. There is a positive indirect effect of global sourcing on sustainability performance through SCM investments.

3. Methodology

In order to investigate the above research propositions, we used the data from the fifth edition of the International Manufacturing Strategy Survey (IMSS 5) collected in 2009. Originally

launched by London Business School and Chalmers University of Technology, this project studies manufacturing and SC strategies within the assembly industry (ISIC 28–35 classification) through a detailed questionnaire administered simultaneously in many countries by local research groups. Responses are then gathered in a unique global database (Lindberg et al., 1998), which is available only to those who have actively participated in data collection. The basic structure of the questionnaire is as follows: the first section of the questionnaire pertains to the business unit, in order to gather general information (e.g., company size, industry, production network configuration, competitive strategy and business performance) on the context in which manufacturing takes place, whereas the other sections refer to the plant's dominant activity, focusing on manufacturing strategies, practices and performance. Dominant activity is defined as the most important activity, which best represents the plant. The plant is chosen as the unit of analysis in order to avoid problems related to business units with multiple plants operating in different ways. In each edition, the questionnaire is partially redesigned in order to ensure alignment with the most recent research goals. To that end, a special section in the last edition was been devoted to the supply chains sustainability issues. Data in each country are gathered in that country's native language and the questionnaire is translated and back-translated to check for consistency (Behling and Law, 2000). Companies are selected from convenience sample or randomly selected from economic datasets and then the operations, production or plant manager is contacted and asked to assist in the research. If the respondent agrees, the questionnaire is sent. Where appropriate, a reminder is sent after a few weeks. Questionnaires that are sent back are controlled for missing data, typically handled on a case-by-case basis by directly contacting the company again. Every country then controls the gathered data for late respondent bias by company size and industry. The overall response rate is 18.3% of the questionnaires sent (10.6% of the contacted companies).

The sample used in this study is described in Table 1. In particular, 413 companies (from the 729 in the global database) provided information for this study (i.e., we deleted records not providing information on the used variables, we deleted cases with less than 20 employees or more than 16,000 from the sample, we deleted cases not providing the ISIC code classification); these companies come from 21 different countries. The sample consists primarily of small companies (51.57% of the sample), but medium and large companies are also represented. Different industrial sectors from the assembly industry are considered.

Table 1 – Descriptive statistics in terms of (a) country, (b) size, (c) industrial sector (ISIC codes)

(a)

Country	N	%	Country	N	%
Belgium	20	4.84	Korea	16	3.87
Brazil	23	5.57	Mexico	9	2.18
Canada	8	1.94	Netherlands	27	6.54
China	34	8.23	Portugal	8	1.94
Denmark	8	1.94	Romania	22	5.33
Estonia	17	4.12	Spain	23	5.57
Germany	22	5.33	Switzerland	23	5.57
Hungary	47	11.38	Taiwan	21	5.08
Ireland	4	0.97	UK	7	1.69
Italy	32	7.75	USA	28	6.78
Japan	14	3.39	**Total**	**413**	**100.0**

(b)

Size*	N	%
Small	213	51.57
Medium	77	18.64
Large	123	29.78
Total	**413**	**100.0**

(c)

ISIC**	N	%
28	145	35.11
29	114	27.60
30	5	1.21
31	52	12.59
32	17	4.12
33	27	6.54
34	34	8.23
35	19	4.60
Total	**413**	**100.0**

* Size**:** Small: less than 250 employees, Medium: 251-500 employees, Large: over 501 employees

**ISIC Code. 28: Manufacture of fabricated metal products, except machinery and equipment; 29: Manufacture of machinery and equipment not classified elsewhere; 30: Manufacture of office, accounting, and computing machinery; 31: Manufacture of electrical machinery and apparatus not classified elsewhere; 32: Manufacture of radio, television, and communication equipment and apparatus; 33: Manufacture of medical, precision, and optical instruments, watches and clocks; 34: Manufacture of motor vehicles, trailers, and semi-trailers; 35: Manufacture of other transport equipment.

With respect to the research framework shown by figure 1, we defined different constructs for SSCM initiatives, Performance and SCM improvements programs. We used exploratory factor analysis (principal component with varimax rotation). To test the quality of our instruments, we checked for discriminant and convergent validity of constructs. The items are inter-correlated (see Table A.1 in Appendix). Moreover, we evaluated the Bartlett's test of sphericity (chi-square = 1477.217; Degrees of freedom = 36; p-value = 0.000) and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO for each variables always greater than 0.698; Overall KMO = 0.779). According to literature (Dziuban and Shirkey, 1974), results support the validity of our instruments. All the measures and constructs are detailed in the following sections.

3.1 SSCM Initiatives

In order to measure SSCM initiatives, we considered 2 items measured on a 1-5 Likert-like scale that refer to the effort spent by companies to implement SSCM programs in the last three years. By running a factor analysis (see table 2), we obtained a one-factor solution (76% of the variance explained), representing the overall investment in the SSCM, with a Cronbach's alpha of 0.729. Therefore, in the rest of the analysis, we considered the a single SSCM factor calculated as the average of the individual SSCM programs).

Table 2 – SSCM initiatives factors loadings and Cronbach's alpha

Item Name	Item description	Factor Loading
Design for environment	Improving the environmental performance of processes and products (e.g. environmental management system, Life-Cycle Analysis, Design for Environment, environmental certification)	.881
Supply chain monitoring	Monitoring corporate social responsibility of partners along the supply chain (e.g. labor conditions, environmental impacts)	.881
	Cronbach's alpha	.729
Eigenvalue > 1; Explained Variance: 76%		

3.2 Sustainability Performance

In order to measure companies' environmental and social performance, we considered 4 items measured on a 1-5 Likert-like scale. We decided to use both performance improvement during the last three years and performance compared to competitor. In this way, we can evaluate the reliability of our final results. Performance improvements and performance to competitor are highly correlated. This means that companies that have improved their performance the most are also more likely to perform better than their competitors.

We performed explanatory factor analysis (Table 3). The validity and reliability of such constructs is assessed by the total variance explained (>82%), factor loadings always higher than 0.902 and the Cronbach's alpha always higher than 0.772 (Nunnally et al., 1967).

Table 3 – Performance (improvement) factors loadings and Cronbach's alpha

Item Name	Item description	Factor Loading
Environmental performance (Improv.)	The extent to which your environmental performance are changed over the last three years	.902
Social reputation (Improv.)	The extent to which your social reputation are changed over the last 3 years	.902
	Cronbach's alpha	.772
Eigenvalue > 1; Explained Variance: 82%		
Environmental performance (Compared)	How your current environmental performance compare with main competitor(s)	.923
Social reputation (Compared)	How your current social reputation compare with main competitor(s)	.923
	Cronbach's alpha	.827
Eigenvalue > 1; Explained Variance: 85%		

3.3 SCM Improvement Programs

In evaluating SCM improvement programs, we used three items that refer to improvement programs in SCM (Table 4). Specifically, we included upstream programs (i.e., supply strategy, supplier development, coordination with suppliers) that can influence the direct

relationship between SSCM initiatives and performance (e.g., Bowen et al., 2001; Pedersen and Andersen, 2006; Roberts, 2003; Simpson et al., 2007).

Items were measured on a 1-5 Likert-like scale, referring to the level of investment in that program in the last three years. These items are inter-correlated (see Table A1 in Appendix). By running a factor analysis, we obtained a one-factor solution, representing the overall investment in supply management, with a Cronbach's alpha of 0.822, which explains 79% of the total variance. Therefore, in the rest of the analysis, we considered the SC investment factor (calculated as the average of the individual improvement programs).

Table 4 – SC improvement programs items, factors loadings and Cronbach's alpha

Item Name	Item description	Factor Loading
Supply strategy	Rethinking and restructuring supply strategy and the organization and management of supplier portfolio through e.g. tiered networks, bundled outsourcing, and supply base reduction	.822
Supplier development	Implementing supplier development and vendor rating programs	.860
Coordination w/ suppliers	Increasing the level of coordination of planning decisions and flow of goods with suppliers including dedicated investments (e.g. information systems, dedicated capacity/tools/ equipment, dedicated workforce)	.845
	Cronbach's alpha	.868
Eigenvalue > 2; Explained Variance: 79%		

3.4 Global Sourcing

To achieve our objective, we needed to measure the extent to which sourcing is globalized. To measure this, we used the percentage of purchases outside the continent where the plant is based. Table 5 provides descriptive statistics for the considered variable. On average, companies tend to be only partially globalized in sourcing but standard deviation also shows a relevant variability within the sample.

Table 5 – Global Sourcing descriptive statistics

Variable	Minimum	Maximum	Mean	Std. Dev.
Global Sourcing	0	100	12.89	19.495

3.5 Control variables

Given the variety of the sample, we decided to control our regression for company size (measured as the number of employees of the company) and GNI per capita (World Bank 2008 data, Atlas method) of the country where the plant is located. Company size is generally considered a relevant contingent variable affecting both SSCM initiatives (Carter and Jennings, 2004; Ehrgott et al., 2011) and SC improvement programs (Cagliano et al., 2008; Carter and Narasimhan, 1990). For Instance, when companies are big, external pressure toward sustainability usually increase as a consequence of the higher visibility on final

markets. We also controlled for GNI per capita given the international nature of the sample. Evidence suggests that companies in different countries show, on average, different attitude toward both SC globalization (Cagliano et al., 2008) and implementation of SC management practices (Fernie, 1995).

Moreover, we decided to control for campaigns that companies have done to directly enhance corporate reputation (i.e., internal investments such as EMS, improving work conditions, corporate social activities, support community projects) but that are independent from investments in the supply chain. Indeed, according to literature (e.g., Carter, 2005; Carter and Jennings, 2004; Gavronski et al., 2011), philanthropy and other internal initiatives are part of companies' corporate social responsibility (CSR) and can significantly increase firm's sustainability performance, both at the corporate and at the supply chain levels. We measured this variable on a 1-5 Likert-like scale, by asking to indicate the effort put into implementing CSR action programs in the last three years. Table 6 provides descriptive statistics for this control variable.

Table 6 – CSR initiatives descriptive statistics

Variable	Min.	Max.	Mean	Std. Dev.
Enhancing corporate reputation through firm's direct contribution and other campaigns (e.g., employment, safety, work conditions, corporate social activities, support community projects)	1	5	3.32	1.107

4. Results

4.1 SCM and SSCM

In order to investigate our first two research propositions, we applied a linear regression. In particular, we studied two regression models, i.e. one for performance improvement during the last three years (model "1") and one for performance compared to competitors (model "2"). For each model we first considered control variables (Size, GNI and CSR initiatives) plus the impact of SSCM initiatives (models "1a" and "2a"), then the impact of SCM improvements programs and the interaction effect of SSCM initiative and SCM improvements were added (models "1b" and "2b"). Finally, according to Dechow (1994), we checked for significant R-square changes by means of the Vuong test. Results of statistical analyses are provided in table 7.

Table 7 – Regression analysis results (bold characters represent variables with p < 0.05)

	1. Performance (Improv.)		2. Performance (Compared)	
Independent	1a	1b	2a	2b
Size (ln)	0.026	0.018	-0.010	-0.017
p-value	*0.369*	*0.519*	*0.742*	*0.586*
GNI	**-0.099**	**-0.104**	-0.008	0.007
p-value	*0.011*	*0.008*	*0.848*	*0.864*
CSR Initiatives	**0.167**	**0.145**	**0.193**	**0.172**
p-value	*0.000*	*0.002*	*0.000*	*0.001*
SSCM Initiatives	**0.319**	**0.276**	**0.336**	**0.269**
p-value	*0.000*	*0.000*	*0.000*	*0.000*
SCM Improvements	-	**0.126**	-	**0.133**
p-value		*0.014*		*0.014*
Interaction (SSCM-SCM)	-	-0.000	-	**0.192**
p-value		*0.994*		*0.000*
Costant	-0.158	-0.118	-0.019	-0.051
p-value	*0.356*	*0.514*	*0.918*	*0.718*
Adj R-square	**26%**	**26%**	**21%**	**26%**
R-square change sig. (p-value)	0.220		**0.018**	
N° of observations	**413**			

A part from size, control variables are significant for both performance measures, in particular GNI is negatively related to improvement over time indicating that this improvement is higher in less developed countries while more developed ones show a lower improvement. Interestingly, GNI has no impact on performance compared to competitors: this mean that, although companies operating in more developed countries show to be improve less, they don't demonstrate to be worse performer. As we can expect, the existence of CSR initiatives is positively related to both performance' measures.

Looking at SSCM, it is significant in models 1 and 2: there is a positive relationship between the extent to which the firm invests in SSCM initiatives and its achievement of high environmental and social performance, confirming RP1.

When we consider the interaction between SSCM and SCM investments, we can see that results are different for models 1 and 2. In particular, the interaction effect is significant only for model 2 (i.e. performance compared to competitors) where it provides a significant change in the R-square. Thus, we can conclude that there is a positive moderation effect of SCM improvement programs on the direct relationship between SSCM initiatives and companies' sustainability performance, confirming RP2 (even if only for performance compared to competitors). Finally, when introduced in the model to test for moderation, SCM investments are significant both for models 1 and 2.

4.2 Global sourcing

In order to consider the impact of global sourcing, we divided the sample in two sub-samples according to the percentage of purchases outside the continent where the plant is based. The two samples were identified according to the mean of this variable in the overall sample. In particular, we identified Local companies as those that purchase less than 13% of their needs outside the continent where the plant is based. On the contrary Global companies are those that purchase more than 13% outside the continent. Based on this classification we run separately regression analyses on the two sub-samples (tables 7).

Table 7 – Regression analysis results for Locals and Globals

(bold characters represent variables with p < 0.05)

		1. Performance		2. Performance	
Groups	Independent	1a	1b	2a	2b
Local	Size (ln)	0.059	0.051	0.024	0.018
	p-value	*0.102*	*0.158*	*0.531*	*0.638*
	GNI	**-0.141**	**-0.013**	-0.040	-0.015
	p-value	*0.003*	*0.003*	*0.435*	*0.761*
	CSR Initiatives	**0.186**	**0.166**	**0.256**	**0.232**
	p-value	*0.001*	*0.003*	*0.000*	*0.000*
	SSCM Initiatives	**0.310**	**0.264**	**0.283**	**0.231**
	p-value	*0.000*	*0.000*	*0.000*	*0.001*
	SCM Improvements	-	**0.125**	-	**0.132**
	p-value		*0.039*		*0.042*
	Interaction (SSCM-SCM)	-	-0.000	-	**0.202**
	p-value		*0.989*		*0.000*
	Costant	-0.356	-0.307	-0.230	-0.257
	p-value	*0.088*	*0.145*	*0.316*	*0.253*
	Adj R-square	**27%**	**28%**	**22%**	**25%**
	R-square change sig. (p-value)	0.306		**0.017**	
	N° of observations	**297**			
Global	Size (ln)	-0.477	-0.05	-0.090	-0.097
	p-value	*0.341*	*0.317*	*0.057*	*0.053*
	GNI	0.020	0.01	0.104	0.093
	p-value	*0.773*	*0.884*	*0.192*	*0.228*
	CSR Initiatives	0.107	0.091	0.005	-0.002
	p-value	*0.207*	*0.303*	*0.954*	*0.979*
	SSCM Initiatives	**0.386**	**0.361**	**0.553**	**0.460**
	p-value	*0.000*	*0.002*	*0.000*	*0.000*
	SCM Improvements	-	0.089	-	0.116
	p-value		*0.382*		*0.247*
	Interaction (SSCM-SCM)	-	0.004	-	0.145
	p-value		*0.954*		*0.087*
	Costant	0.287	0.293	0.520	0.466
	p-value	*0.356*	*0.353*	*0.096*	*0.134*
	Adj R-square	**23%**	**22%**	**27%**	**29%**
	R-squared change sig. (p-value)	0.422		0.422	
	N° of observations	**116**			

Results show that Global Sourcing is influencing the impact of the considered variables on sustainability performance. First of all, control variables show some differences. While for Locals the effect of control variables is the same than for the overall sample, for Globals none of the control variables is significant. Most interestingly, Global do not receive any benefit from CSR initiatives.

Looking at SSCM, its positive effect on performance is confirmed for both groups as for the overall sample. Interestingly, for Globals the effect of SSCM on performance is higher than for Locals witnessing a positive moderation effect (that is contrary to what stated in RP3).

Next, the interaction effect of SCM and SSCM is confirmed only for Locals and not for Globals. We can argue that there is a negative moderation effect of global sourcing on the relationships among SSCM initiatives, SCM investments and sustainability performance, contrary to what stated in RP4. We also performed a sensitivity analysis on the threshold used to divide between Locals and Globals. For instance, using a threshold of 5% - that is the median of global sourcing in our sample – or using a threshold of 20% does not change the results presented.

Looking at SCM we found another interesting result. The direct effect of SCM on sustainability performance, that was present for the overall sample and Locals, disappears for Globals. It means that Global firms that have improved the most their performance (both during time and compared to their competitors) have focused their attention on SSCM investments. Conversely, Local firms that have achieved highest environmental and social performance have devoted attention to SCM, SSCM and internal CSR investments, trying to leverage on the positive effect of these initiatives.

To better understand these results, we also performed comparative statistics on model's variables between global and local firms (see table A.2 in appendix). Both parametric and non-parametric approaches show that Global companies are larger, they tend to operate within advanced economies and have invested more on CSR initiatives. Furthermore, Global and Local companies show similar environmental and social performance and they have putted the same effort to develop SSCM initiatives. Differently, our analysis shows that Global firms have invested significantly more in SCM programs than Local companies. This fact explains the reason why Global firms that have achieved high sustainability performance have focused their investments on SSCM initiatives (i.e., they have already invested more into both CSR initiatives and SCM programs).

5. Discussion and Conclusion

In this work we empirically investigate the direct influence that SSCM initiatives can have on environmental and social performance of firms. Furthermore, we investigated the role played by two other factors: SCM improvements programs and global sourcing. Our results allow us to highlight several considerations.

First, consistently with recent literature (Ateş et al., 2011; Carter and Rogers, 2008; Gavronski et al., 2011; Seuring and Muller, 2008), we found empirical evidence that demonstrates how monitoring CSR of supply chain partners as well as developing LCA to design new sustainable products/processes represent effective ways to enhance companies' sustainability performance. Such SSCM initiatives entail problem-solving routine involving suppliers, instil additional capabilities in the company's organization and lead to superior sustainability performance (Ateş et al., 2011). Hence, we were able to expand former literature by studying social and environmental aspects simultaneously.

Then, we found a positive and significant relationship between companies' SCM investments and firms' sustainability performance. Moreover, when we specifically considered companies' sustainability performance compared to competitors, we found a positive and significant moderation effect played by SCM action programs on the direct relationship between SSCM initiatives and performance. This results is consistent with previous contributions (Bowen et al., 2001; Gold et al., 2010; Jiang, 2009; Roberts, 2003) suggesting that companies need to support SSCM initiatives with specific investments that aim to (1) increase visibility within supply chain, (2) improve companies' ability to manage strategic supply relationships as well as (3) enhance coordination and cooperation among supply partners. Thus, this work adds empirical evidence to SSCM literature by confirming what suggested by previous contributions (Zhu et al., 2007): companies aiming to enhance the effectiveness of their SSCM initiatives should rely on specific SCM investments. Our results are also in line with Vachon and Klassen (2008) concluding that partnering approaches and collaborative programs with suppliers have a positive impact on environmental performance.

We finally considered the role played by global sourcing in influencing the relationships among the previously cited variables. We found that both Global and Local firms benefit from direct investments on SSCM initiatives. However, it seems that Global companies, though having invested more (see table A2), do not receive any benefits from the adoption of internal CSR programs as well as from SCM improvements programs. These result aligns with the model proposed by Gavronski et al. (2011): since SSCM requires more internal effort and external coordination with supplier than traditional CSR initiatives or supply management,

companies first develop a set of internal resources (i.e., resulting from preliminary internal CSR investments as well as SCM improvements programs), then can effectively rely on SSCM initiatives. Accordingly, Rao (2002) pointed out that supply chain environmental programs arise as a subsequent step to environmental initiatives undertaken internally. In the same vein, we found that Global companies, that are larger and operate in more developed countries (see table A2), have relied more on internal programs and on SCM improvement programs (see table A2). Thus, they are now concentrated on SSCM initiatives, that allow them to exploit supply chain partner potential and further improve their environmental and social performance. As a result, we can argue that internal investments and SCM investments can represent a source of competitive advantage for companies that manage local suppliers, while they represent a preliminary and needed expenditure for those who are orchestrating global supplies. Our arguments are also consistent to Aragon-Correa and Sharma (2003). The authors theoretically posit that complexity in general business environment strengthens the association between proactive environmental strategies and performance. Since global sourcing contributes to the structural complexity of the supply chain (Wagner and Bode, 2006), it forces companies to develop superior interior capabilities and then, based on those, effectively conduct SSCM initiatives.

This paper thus contributes to the literature on sustainable supply chain management by providing empirical evidence of the impact of SSCM initiatives (i.e., monitoring suppliers' CSR, developing LCA to design new product/processes), SCM investments and global sourcing on both social and environmental performance of companies operating all around the world. We argue that this contribution can support previous literature's findings and stimulate further empirical research on this topic.

In the end we would like also to address some of the main limitations of this work. First of all, we use a perceptive measure of social and environmental performance. Literature lacks of quantitative performance indicators but future works should refer to them to increase the reliability of our results. Second, attention here was paid only to supply side investments, thus not considering what companies are doing on the distribution side. In the end, attention has been limited only on some specific supply chain investments; future works could examine if other SCM investments are promoted by companies (e.g., risk management).

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Appendix

Table A.1 – Inter-correlation matrix

	Design for environment	Design for environment	Environmental performance (Improv.)	Social reputation (Improvement)	Environmental performance (Compared)	Social reputation (Compared)	Supply strategy	Supplier development	Coordination with suppliers	Global Sourcing
Design for environment	1	**0.55****	0.43**	0.30**	0.38**	0.31**	0.25**	0.38**	0.31**	0.09*
Supply chain monitoring	**0.55****	1	0.39**	0.38**	0.36**	0.37**	0.32**	0.42**	0.44**	0.10*
Environmental performance (Improv.)	0.43**	0.39**	1	**0.62****	0.45**	0.36**	0.22**	0.34**	0.23**	0.03
Social reputation (Improv.)	0.30**	0.38**	**0.62****	1	0.36**	0.49**	0.21**	0.31**	0.24**	0.01
Environmental performance (Compared)	0.38**	0.36**	0.45**	0.36**	1	**0.70****	0.22**	0.31**	0.27**	0.04
Social reputation (Compared)	0.31**	0.37**	0.36**	0.49**	**0.70****	1	0.18**	0.2**	0.27**	0.04
Supply strategy	0.25**	0.32**	0.22**	0.21**	0.22**	0.18**	1	**0.56****	**0.53****	0.13**
Supplier development	0.38**	0.42**	0.34**	0.31**	0.31**	0.32**	**0.56****	1	**0.60****	0.13**
Coordination w/ suppliers	0.31**	0.44**	0.23**	0.24**	0.27**	0.27**	**0.53****	**0.60****	1	0.17**
Global Sourcing	0.09*	0.10*	0.03	0.01	0.04	0.04	0.13**	0.13**	0.17**	1

* sig. < 0.05 ; ** sig.< 0.01

Determinant: 0.027; Bold estimates demonstrate higher correlations between items belonging to the same factor

Table A.2 – Mean comparison test between Local and Global on model's variables.

	Sample Avarage	Local	Global	t-test Sig.	KS-test Sig.
Environmental performance (Improv.)	3.05	3.02	3.13	0.28	0.36
Social reputation (Improv.)	2.97	2.96	3.01	0.61	0.41
Environmental performance (Compared)	3.34	3.33	3.39	0.46	0.90
Social reputation (Compared)	3.44	3.40	3.53	0.16	0.81
Design for environment	2.88	2.83	3.03	0.16	0.49
Supply chain monitoring	2.63	2.58	2.72	0.12	0.39
Supply strategy	**3.03**	**2.95**	**3.24**	**0.02**	**0.08**
Supplier development	**3.10**	**3.03**	**3.28**	**0.04**	**0.27**
Coordination w/ suppliers	**2.91**	**2.80**	**3.18**	**0.00**	**0.00**
Size (N° of Employees)	**293**	**732**	**1380**	**0.00**	**0.00**
GNI per capita (Euro)	**28540**	**26426**	**34020**	**0.00**	**0.00**
CSR Initiatives	**3.32**	**3.23**	**3.53**	**0.01**	**0.07**