

Supply chain sustainability: the key role of trust and suppliers' performance

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Abstract

Does sustainable supply management (SSM) (i.e., supplier monitoring and collaboration) contribute more to supply chain sustainability compared to sustainable process management (SPM) (i.e., management system and certifications)? Does the improvement of suppliers' sustainability performance contribute significantly to a firm's sustainability performance? Does trust have significant implications for supply chain sustainability? To provide an answer a conceptual framework has been developed and tested by applying the PLS methodology on a sample of 71 firms. Results show that SPM enables SSM and impacts firms' sustainability performance. Further, in presence of trust, SSM impacts suppliers' sustainability performance and, indirectly, a firm's sustainability footprint.

Keywords: sustainable supply chain, suppliers' performance, trust

Introduction

Sustainability performance, intended as the environmental and social dimensions of the triple bottom line, is nowadays a key concern for companies. Firms are expected to continuously control the positive and negative externalities of their supply chains.

In this regard Operations Management literature has been of a great help to businesses. Several best practices have been identified and classified into two main groups according to whether the focus is within the company's boundaries or outside them (Bowen et al., 2001). Sustainable process management (SPM) refers to a company's institutionalization of internal environmental and social management systems such as ISO 14001, OHSAS 18001. Sustainable supply management (SSM), instead, refers to supplier monitoring and collaboration, a set of mechanisms implemented at the company level to assess or improve the environmental and social performance of a supplier base. The literature has shown that the adoption of these practices can generate financial benefits for the focal firm, mainly by boosting productivity and reducing risks. The literature has also shown that environmental and social commitment by top management and employees is absolutely necessary to deploy such practices effectively (Ateş et al., 2011). Furthermore, it has been suggested that strategic supply capabilities are an essential prerequisite when developing sustainable supply chains (Bowen et al., 2001).

Less attention, however, has been paid on the impacts that SPM and SSM have on a supply chain's sustainability performance. Scarce support is given to companies that embark in SPM and SSM to exploit the potential that lies behind these practices. The literature, for instance, does not provide any clue that can lead firms to understand whether to undertake such practices jointly (Ateş et al., 2011) or subsequently (Gavronski et al., 2011). With regards to SSM, literature suggests that it should be leveraged to build up suppliers' own capabilities to deal with environmental and social issues (Mamic, 2005). Nevertheless, little is known about the direct impact that SSM has on suppliers' environmental and social performance and on the indirect benefits that firms can derive from the improved suppliers' sustainability footprint. The most of the studies, in fact, has focused on the economic benefits that firms derive from such levers. Finally, recent literature seems to suggest that partnering approaches and relational norms of governance allow deploying SSM in a more effective way (Bowen et al., 2001; Simpson et al., 2007; Jiang, 2009). This result calls for further exploration and testing of the influence that trust in buyer-supplier relationships can play along the development of more environmentally and socially sustainable supply chains.

These gaps provide a strong motivation for our research. This work, in fact, aims at shedding further light on the way companies can improve supply chain sustainability. Specifically, three research question are here addressed: 1) does sustainable supply management contribute more to supply chain sustainability compared to sustainable process management? 2) does the improvement of suppliers' sustainability performance contribute to a firm's sustainability performance? 3) does trust have significant implications for supply chain sustainability?

To address these research questions, a conceptual framework has been developed and tested by means of a survey approach (Forza, 2002). This research seeks to extend the small but growing body of knowledge surrounding the impact that internal and external sustainability practices has on supply chain sustainability. The major contribution of this research will be not just to explore the existence of links between practices, suppliers' sustainability performance and buying firms' sustainability performance, but also to explore the influence of a specific exchange condition (trust) on the effectiveness of sustainability-oriented practices.

Background and hypotheses development

The theoretical framework to be examined in this study is depicted in Figure 1.

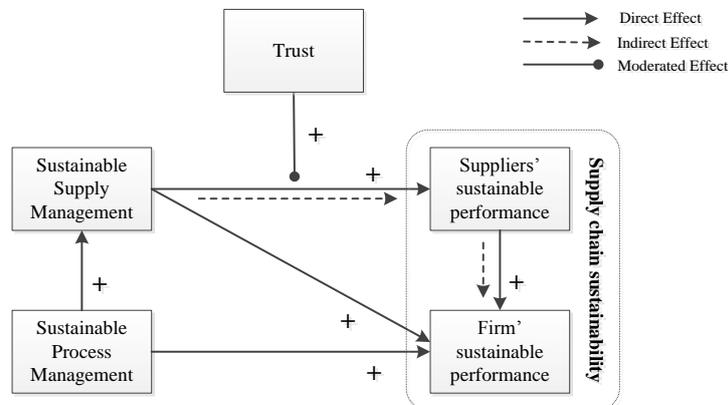


Figure 1 – Theoretical Model

The starting point for this work is the path-dependence model of the resource based view of the firm. Here, in fact, we argue that firms should implement sustainable process management first and move toward sustainable supply management only when organizational capabilities in environmental and social management have been developed. Specifically, SPM can enable the development of SSM in different ways. First, companies adopting sustainable process management will probably have mature environmental and social systems in place and will start looking at their current suppliers in search for new opportunities to improve their footprint (Gavronski et al., 2011). Second, since the development of product stewardship and of environmental and social collaboration are learning and knowledge intensive processes that requires substantial effort, it will be more likely adopted in companies with sophisticated management systems, such as those with an institutionalized sustainable process management. Moreover, it is possible that suppliers do not have environmental and social skills and will require guidance and or incentives from the focal firm. So the focal firm may have to make these investments internally and then transfer them to suppliers (Pagell et al., 2007). Finally, practices such as ISO14001 requires identifying important environmental issues in the relationship with suppliers (MacDonald, 2005), thus driving companies towards the consideration of supply chain sustainability issues.

Therefore, the first hypothesis we consider is as follows:

RH1. Sustainable process management is positively related to sustainable supply management.

Sustainable process management, however, is mainly directed towards the improvement of a firm's sustainability performance. A firm can gain competitive advantage by pursuing environmental strategies and developing innovative technologies that allow for pollution prevention or minimizing emissions, effluents and waste. For instance, manufacturing structural investments aiming to reduce pollution at the source, ISO 14001 certifications, facility-level resource conservation practices and environmental proactivity are all positively linked to environmental performance (Pullman et al., 2009). In the same vein, social standards (OHSAS 18001, SA8000) contribute to achieving better employees' quality of life, safer and healthier workplaces, more efficient work processes, improved employee perceptions of the working environment, and greater recruitment attractiveness. Thus, our second hypothesis states that:

RH2. Sustainable process management is positively related to firms' sustainability performance

SSM, differently, is deployed to improve suppliers' sustainability performance. Firms can use SSM to assure suppliers' compliance with internally or externally endorsed sustainability standards. Supplier development, which can be defined as activities that include plant visits, supplier audits, and supplier training to improve suppliers' performance is often an indirect part of SSM. For example, buying organizations might work with suppliers to make changes to production processes, packaging, and product design in terms of environmental initiatives and might visit and qualify supplier plants in terms of human rights issues (Carter, 2005). Existing research has also shown how suppliers' environmental and social commitment is positively related to the definition of minimum performance requirements by major customers (Simpson et al., 2007). Suppliers' involvement in life cycle analysis and re-engineering

practices, for instance, further contributes to suppliers' awareness building and can result in the identification of effective solutions to improve suppliers' sustainability performance. Thus, we propose the following hypothesis:

RH3 Sustainable supply management is positively associated to suppliers' sustainability performance

Also, SSM may impact firm's internal sustainability performance. SSM allows reducing the environmental impact associated with material flows in the supply chain. The effort due to sustainable purchasing approaches may have a relatively low impact on supplier's performance but results in a more integrated supply chain and an overall decrease in waste that includes water, energy, fuel consumption and decreased packaging (Kumar et al., 2012). Sustainable supply management also consists of a good understanding of each other's responsibilities and capabilities regarding environmental management, leading to inter-organizational learning in buyer-supplier relationships. Vachon and Klassen (2008) suggest that environmental collaboration with suppliers often entails joint problem-solving sessions, information sharing, establishing common goals, and personnel and equipment sharing with suppliers. For instance, environmental collaborations include the exchange of critical information and require a mutual willingness to learn about each other's operations to plan and set goals for environmental improvements (Gavronski et al., 2011). Thus, it seems plausible that by pushing suppliers toward the adoption of environmental and social programs, focal firms could find new ways to directly improve their own footprint. Thus we consider the following hypothesis:

RH4. Sustainable supply management is positively associated to firms' sustainability performance.

Extant literature has asserted that supplier performance is one of the key determinants of the buyer firm's performance and ability to create value. Firms that are open to ideas from suppliers have found them to be an important source for novel ideas and process improvements. For example, Carter (2005) finds a significant relationship linking purchasing social responsibility, improved supplier performance (i.e., quality, efficiency) and lower production and quality costs for the buying organization. In the environmental literature, Geffen and Rothenberg (2000) indicate that more sustainable and innovative suppliers led to environmental improvements in the buyer organization. Thus, suppliers in a well-managed chain can be source of long lasting competitiveness for the buyer firm.

RH5. Suppliers' sustainability performance is positively associated to firms' sustainability performance.

RH6. Suppliers' sustainability performance mediates the relationship between sustainable supply management and firms' sustainability performance.

Finally, we investigate the role of trust in the domain of supply chain sustainability. Companies often choose to use a range of measures to encourage their suppliers to meet their performance requirements. The choice and success of these measures of "encouragement" are often referred to as relationship "conditions" that determine its power or influence over the supplier and its choices (Simpson et al., 2007). It is an important proposition of this study that suppliers' sustainability performance will not

only be influenced by SSM, but that the magnitude of this influence will depend on the existing conditions of the buyer-supplier relationship.

The relational view of inter-organizational competitive advantage suggests that having close ties with a limited number of suppliers fosters greater trust, allows transferring key knowledge and facilitates reciprocal monitoring and learning (Dyer and Singh, 1998). Trust, defined as one party's confidence in the reliability and integrity of the other partner in an exchange relationship (Morgan and Hunt, 1994), allows linked companies to assume that each will take actions that are mutually acceptable. Suppliers and the improvement of their performance can see trust as an important condition for the development of partner-specific absorptive capacity. The development of trust is also subjected to considerable causal ambiguity, because it is highly complex and situation specific process, and to time compression diseconomies, because it cannot be developed quickly, nor can it be bought or sold in the marketplace. Thus, it can be source of competitive advantage for firms and its suppliers.

RH7. Trust positively moderates the relationship between Sustainable supply management and suppliers' sustainability performance

Methodology

Data collection

Data were collected following a survey approach (Forza, 2002). First, we obtained an original sample of 500 manufacturing firms randomly selected from the Aida database (www.aida.bvdep.com). Attention was focused on manufacturing sectors. Supply chains within these industries directly and indirectly relate to economic wealth creation as well as are responsible for impacts on the natural and human environment along all stages of the products' life cycle. Data collection took place between in 2012, from June to December. A total of 71 companies provided useful and complete information for this research (effective response rate is 14%). Given that senior executives (purchasing or supply chain managers) are nowadays inundated with multiple requests to participate in surveys, this response rate is higher than many recent studies within the field of supply chain management (Carter et al., 2005). Sample's characteristics are shown by Table 1

Table 1 – Descriptive statistics in terms of (a) size and (b) industrial sector

(a)			(b)	
Size*	N	%	ISIC	%
Small	20	28.17%	20	2,82%
Medium	24	33,80%	22	5,63%
Large	27	38,03%	25	4,23%
Total	71	100	26	2,82%
			27	26,76%
			28	45,07%
			29	9,86%
			30	2,82%
			Total	100

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

** ISIC codes. ISIC 20: Manufacture of chemicals and chemical products; ISIC 22: Manufacture of Rubber and Plastics products; ISIC 25: Manufacture of fabricated metal products, except machinery and equipment; ISIC 26: Manufacture of computers and electronic and optical products; electro-medical equipment, metering equipment and watches; ISIC 27: Manufacture electrical equipment and non-domestic electric appliances; ISIC 28: Manufacture of machinery and equipment not elsewhere classified; ISIC 29: Manufacture of motor vehicles, trailers and semi-trailers; ISIC 30: Manufacture of other means of transport

We examined non-response bias in two ways. First, a comparison of number of employees across respondents and a randomly selected set of non-respondents from the

overall sample frame revealed no significant differences. Second, respondents were divided in two groups considering their responsiveness in providing data. A comparison of all the variables addressed in this study across early (i.e., the 14 most responsive companies) and late respondents (i.e., the 14 less responsive companies) show that these groups were not significantly different from each other ($p < 0.05$).

Survey questionnaires and measures

The development of the survey instrument follows the stepwise procedure of item generation (Churchill Jr, 1979). Table A1 in appendix provides an overview of the questions employed by the instrument. Measures are also discussed below.

Sustainability Performance. Sustainability performance is measured by three items, based on a five-point Likert scale, related to the amount of energy efficiency, workplace health and safety, and bad emissions (air and water emission, solid disposal). This measure has been developed and applied by previous literature that shows how these dimensions covariate.

Sustainable supply management. A four item scale measures the effort spent in (i) sending questionnaires to suppliers in order to evaluate their sustainability performance (ii) pushing suppliers towards the adoption of social and environmental certifications, (iii) auditing suppliers' plants, (iv) working together with suppliers to reduce negative impacts of products (v) collaborating with them to reduce the negative impacts of processes and operations (vi) working with them to prevent or solve environmental and social issues. Similar metrics are developed and tested by the literature

Sustainable process management. The extent of social and environmental practices within the company is assessed by a three-item scale which captures the extent to which effort is put in developing (i) environmental management systems (ISO 14001), (ii) health and safety systems (OHSAS 18001) and (iii) code of conducts.

Trust. According to the scale proposed by Benton and Maloni (2005), it has been measured by a three-item scale, which captures the extent to which (i) suppliers are concern about the firm's welfare, (ii) suppliers consider how their decisions/actions affect the company and (iii) suppliers look for the firm's best interest.

Control variables: this work controls for company size, measured by the number of employees.

Data analysis and results

To test our model we relied on partial least squares (PLS). We performed PLS algorithms as implemented in the SmartPLS 2.0 software (Ringle et al., 2005). PLS is here appropriate because the sample size is small, assumptions of multivariate normality and interval scaled data cannot be made, and the study is primarily concerned with prediction of the dependent variable. In our case, the general rule of thumb regarding an appropriate sample size when using PLS is to multiply by ten the greater number of paths leading to a dependent variable (i.e., 50 cases) (Peng and Lai, 2012).

Measurement model

As summarized by table 2, many criteria were considered to guarantee the reliability and validity of our measures.

Table 2. Summary of measurement scales and constructs validity

<i>Items</i>	<i>Items loading</i>	<i>Internal consistency</i>	<i>Alpha</i>	<i>AVE</i>
Firm's sustainability performance		0.87	0.78	0.69
FSM1	0.77			
FSM2	0.86			
FSM3	0.86			
Suppliers' sustainability performance		0.79	0.66	0.56
SSP1	0.71			
SSP2	0.73			
SSP3	0.81			
Sustainable supply management		0.95	0.94	0.76
SSM1	0.82			
SSM2	0.85			
SSM3	0.85			
SSM4	0.92			
SSM5	0.87			
SSM5	0.92			
Sustainable process management		0.87	0.79	0.69
SPM1	0.87			
SPM2	0.81			
SPM3	0.82			
Trust		0.87	0.82	0.70
TR1	0.87			
TR2	0.96			
TR3	0.64			

First, individual items reliability is testified by high measures' loading with their respective construct. Second, convergent validity and uni-dimensionality (Fornell and Larcker, 1981) for all the items were confirmed by showing significant standardize loadings with their underlying constructs in a simultaneous estimation of the measurement and structural models in PLS. In support to convergent validity, the Average Variance Extracted (AVE) of constructs is always higher than the recommended minimum of 0.5 (Fornell and Larcker, 1981) (see table 2). Composite reliability is then testified by good construct reliability and good internal consistency and internal consistency the results show that all items refer consistently to their respective construct. Then, concerning to discriminant validity (Hulland, 1999), 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).

Table 3. Construct explained variance, correlation and discriminant validity

	R ²	FSP	SSP	SSM	SPM	TR
Firm's sustainability performance (FSP)	43.6%	0.83				
Suppliers' sustainability performance (SSP)	18.4%	0.61	0.75			
Sustainable supply management (SSM)	55.6%	0.13	0.01	0.87		
Sustainable process management (SPM)	-	0.33	0.08	0.74	0.83	
Trust (TR)	-	-0.06	-0.11	0.37	0.29	0.83

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

Structural model

Bootstrapping was used to test the statistical significance of model paths. This procedure entails generating 500 sub-samples of cases randomly selected, with replacement, from the original data. The analysis showed that our model represent the best solution. Results for tests of the propositions are shown in Table 4.

Table 4. PLS structural model results

Paths	<i>Direct and Indirect effects</i>		<i>Direct, indirect and moderated effects</i>	
	Standardized coefficient	t-value	Standardized coefficient	t-value
SPM → SSM	0.746	14.85***	0.746	15.198***
SPM → FSP	0.388	2.13**	0.401	2.223**
SSM → SSP	0.041	0.211	-0.140	0.931
SSM → FSP	-0.151	0.856	-0.180	0.951
SSP → FSP	0.577	6.531***	0.556	4.826***
SSM*TR → SSP	-	-	0.461	2.334**
Variance explained in SPM	46.0%		43.6%	
Variance explained in SSM	1.40%		18.4%	
Effect size of the moderating variable on SPM			0.21 ⁺	

*p-value < .10; **p-value < .05; *** p-value < 0.01 with d.f. > 60

⁺ the effect size is calculated using the equation $f^2 = (R^2_{\text{included}} - R^2_{\text{excluded}}) / (1 - R^2_{\text{included}})$

First, the impact of sustainable process management on sustainable supply management is positive and strongly significant, supporting RH1. Also, SPM produces positive implications for firms' sustainability performance, supporting RH2. SSP does not seem to directly impact supply chain sustainability: sustainable performance of both the company and its suppliers are not directly influenced by sustainable supply management routines (rejecting RH3, RH4). Interestingly, suppliers' sustainability performance positively and significantly impacts the firm's sustainability performance (supporting RH5). Since SSM does not significantly relate to supply chain sustainability, the hypothesis of a mediation effect played by suppliers' sustainability performance cannot be tested (RH6 rejected). It is very noteworthy that RH7 is supported: trust significantly and positively moderates the effect exerted by SSM and suppliers' sustainability performance. Only when trust is high, sustainable supply management impacts supply chain sustainability. We highlight that the effect of the interaction between trust and SSM is quite strong.

Discussion and conclusion

This research makes at least three key contributions to extant research. First, we provide empirical evidence that support arguments recently proposed by the literature (Ates et al., 2011; Gavronski et al., 2011): intra-organizational practices (SPM) have a direct and positive impact on inter-organizational practices (SSM) and on the performance of the focal firm. Environmental and social standards (i.e., ISO 14001, SA8000) require relevant environmental and social aspects to be identified. Therefore, once all internal aspects are covered, managers will start looking for opportunities upstream in their supply chain. However, because environmental collaboration with suppliers is a learning and knowledge intensive process requiring substantial effort and investment, it is more appropriate only in firms that have reached advanced stages of environmental and social management.

Second, SSM is not resulting in a homogenous performance across all suppliers as might have been expected from the findings described by previous research, but is instead impacting on suppliers in a more heterogenous manner according to the trust characterizing the buyer-supplier relationship. By relying on the relational view (Dyer and Singh, 1998), we support the idea that asset-specific investments and relational norms of governance, being at the same time consequences and sources of trust in buyer-supplier relationship, allow to deploy SSM effectively.

Finally, we found that suppliers in a well-managed chain can be source of superior sustainability performance for the focal firm. In this way we extend the findings of

previous literature that were mainly focused on the economic and the environmental dimension of the triple bottom line. Trustful buyer-supplier relationships through which supply partners share important information concerning materials procurement and product design issues can (1) improve the environmental and social performance of products, (2) reduce waste and disposals for the focal firm, (3) improve workplace safety and health at the buyer organization. Our result, thus, reinforces the argument that a company is only as sustainable as its suppliers (Krause et al., 2009).

These findings allow us to derive managerial implications for companies. First, the achievement of superior environmental and social sustainability requires the development of both internally and externally oriented practices. Sustainable process management can allow taking low hanging fruits and developing a good understanding on how environmental and social issues should be managed. Then, companies should look within their supply chain and walk with suppliers to gain further significant improvements. Trust in such cases must be present: it is a necessary pre-requisite that enacts suppliers commitment and allows for the development of joint problem-solving routines that in turn can allow firms to further improve their sustainability performance.

Our study points to a number of avenues for future research. First, our research design, a cross-sectional survey, does not allow the temporal sequence necessary to assess causality. Future research should include longitudinal designs to provide conclusive evidence of our model. Second, data has been collected only in one country and thus, even if the data collection process has been properly and accurately designed, still a country effect could be possible. Further data collection in other countries could verify whether these results could be generalized. We argue that since some of our results are aligned with other empirical works developed in different countries (Pagell et al., 2007; Gavronski et al., 2011), generalizability should not be a major concern. A final issue is associated to the number of companies providing complete answers to our survey. Previous works allow us to consider the sample size acceptable for the purpose of this work (Ateş et al., 2011; Hollos et al., 2012). Obviously, a wider sample would allow verifying the reliability of our results. Finally, our analysis support the relational view's argument that a singular focus on the firm as unit of analysis may limit the explanatory power of the model we develop to explain firm level performance. However, future studies should collect data from both firms and suppliers, providing further support to the results of this research.

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Appendix

Table A1: Questionnaire's items

Var.	Items (measured on a 5-point likert scale)	Reference
<i>In the last three years, to what extent has your organization's sustainability performance changed in the following areas (1: Much worse; 5: Much better)</i>		
	FSP1. Energy efficiency	(Pagell et al., 2007)
	FSP1. Health and Safety of employees	
	FSP2. Bad Emissions (air and water emission, solid disposal)	
<i>In the last three years, to what extent has your key suppliers' sustainability performance changed in the following areas (1: Much worse; 5: Much better)</i>		
	SSP1. Energy efficiency	(Pagell et al., 2007)
	SSP1. Health and Safety of Employees	
	SSP2. Bad Emissions (air and water emission, solid disposal)	
<i>Indicate the effort put into implementing the following action programs in the last three years (1: none; 5: high)</i>		
SSM	SSM1. Sending questionnaires to suppliers in order to assess their environmental and social	(Gavronski et al., 2011)
	SSM2. Requiring suppliers' environmental and social certifications (e.g., ISO 14001,	
	SSM3. Auditing suppliers' plant to assess their environmental and social performance	
	SSM4. Working together with suppliers to reduce social and environmental impacts of products	
	SSM5. Collaborating with suppliers to reduce social and environmental impacts of processes and	
	SSM6. Conducting joint planning to anticipate and resolve sustainability related problems	
SPM	SPM1. Environmental management systems or certifications (e.g., ISO 14001)	(Pagell et al., 2007; Gavronski et al., 2011)
	SPM2. Workplace health and safety (e.g., OHSAS 18001)	
	SPM3. Code of conducts addressing environmental, social and ethical issues	
<i>Please, indicate how much do you agree with the following statements (1: Strongly disagree; 5: strongly agree)</i>		
Trust	TR1. Our suppliers are concern about our welfare	(Benton and Maloni, 2005)
	TR2. Our suppliers consider how their decisions/actions affect us	
	TR3. Our suppliers look out for our best interest	