Sustainability along the Value Chain: Collaborative Approaches and their Impact on Firm Performance*

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Abstract

Heeding the call for a deeper understanding of the key differences in corporate approaches to sustainable supply chain management (SSCM) and their impact on performance, we collect and analyse data on a sample of 91 Italian firms in the consumer product industry engaged in upstream and downstream sustainability initiatives. Results show that companies differ in the extent to which sustainability is shared along the chain. Yet, the more companies collaborate through a strong sustainability orientation, the higher the impact on supply-chain related performance, with companies adopting a proactive attitude to SSCM being able to benefit the most from it.

Keywords: Sustainable Supply Chain Management; Corporate Social Responsibility; Collaborative Approach; Stakeholder Management

1. Sustainability and Supply Chain Management in a Global Economy

In the search for new sources of competitive advantage in a global economy, companies have rapidly adopted flexible production methods, made of combinations of specialization, outsourcing and contracting with multiple suppliers, thus leading to the creation of global value chains (Lambin 2009; Lim, Phillips 2008). Political economy, public opinion, and managerial literature have started to be concerned with the developmental consequences of value chain disaggregation, pointing out to the need for and benefits of voluntarily integrating social and environmental issues (sustainability issues, hereafter) into supply chain management (SCM) approaches (Drake, Schlachter 2008; Salvioni, Astori 2013). As a result, research on SCM processes and practices has been progressively extended to the analysis of collaborative orientation along the supply chain and of

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company attempts to move away from mere cost-reduction strategies based on cost-cutting delocalization decisions (Maloni, Brown 2006).

In this area, a remarkable interest has been addressed to the identification of the sustainability challenges faced by firms in managing upstream and downstream supply chain relationships. Early emphasis on stand-alone areas of sustainability in the supply chain, such as environmental protection (Carter, Carter 1998) and sourcing from minority businesses, has been progressively replaced by more holistic, higher-order conceptualizations (Carter, Jennings 2004), aimed at providing a more comprehensive view on the whole array of social and environmental issues occurring in the relationships among those (i.e., suppliers, consumers and logistics providers) working together to deliver a value package of goods and services to the end customers (Maloni, Brown 2006).

Within the above context, the focus on disentangling the specific dimensions and content of sustainable supply chain management (SSCM) has not been paralleled by a comparable efforts in identifying, comparing and contrasting the different approaches to SSCM implementation (Vurro et al. 2009). This becomes especially relevant in face of the spread of commerce over a large number of countries and constituencies, which has necessitated improvement and modernization of coordination and control systems. As a result, collaborative practices are spreading to strengthen trust and reduce abuse of power among firms in the supply chain, in an attempt to overcome the reputational and market risks related to suppliers' cheating behaviour on fair practices along the value chain (Mamic 2005).

In this regard, preliminary evidence shows that firms are increasingly working on updating codes of conduct and collaborative practices to maintain and strengthen corporate reputation and legitimacy (Cooper et al. 2000; Maignan et al. 2002).

Despite converging on the prescriptive conclusion that the ability to gain from SSCM is inextricably linked to more integrative approaches in which systematic collaboration along the supply chain is associated to long-term buyer-supplier relationships based on knowledge and competence sharing (Lim, Phillips 2008), both variation in collaborative approaches to SCM and related performance consequences deserve further empirical validation (Perrini, Vurro 2010).

Based on these gaps in the extant research and heeding the call for a more systematic attention to the notions of sustainability in the value chain (Brondoni 2010; Phillips, Caldwell 2001), our study starts from identifying different models of SSCM, defined in terms of both the extent to which collaborative sustainability-related practices are integrated into company approaches to SCM and the related, underlying dominant corporate interpretation of what it means to be sustainable along the supply chain. Then, the performance consequences of implementing a specific model of SSCM are tested, distinguishing between upstream and downstream SSCM.

The remainder of the paper looks as follows. After an elaboration on the topics of SSCM in the next section, we turn to an explanation of our research design and data collection method. We then present the results of our empirical analysis. The paper ends with the discussion of the findings, pointing out to emerging issues in guiding future research.

2. Managerial Approaches to Sustainability in the Value Chain and their Performance Consequences

The search for renewed approaches to SCM based on the discretionary allocation of corporate resources toward the improvement of cross-boundary social and environmental performance has been the most direct result of the disaggregation of the value chain due to the progressive specialization of firms on single competence areas (Daboub, Calton 2002; Faraoni, Petretto 2009). In fact, while turning into economic gains, subsequent waves of outsourcing and sub-contracting have lead to a general loss of control over the stages of the production and distribution processes. In the most extreme cases, economic pressures on cost reduction have encouraged suppliers, usually in less developed countries, to cheat on fair practices to avoid costly changes and loss of competitiveness, fostering a general decrease in quality, innovation, as well as stakeholder trust and opportunities for long-term value creation (Lim, Phillips 2008; Maloni, Brown 2006). As a result, the risks of exposure to stakeholder criticisms of perceived social and environmental deficiencies have dramatically increased (Mamic 2005), thus setting the stage for engaging into sustainable practices aimed at managing and anticipating potential legitimacy threats due to misconducts along the value chain (Pepe 2007; Perrini, Russo 2008).

However, besides the need to manage reputational and legitimacy risks of being deemed responsible for suppliers' actions, the diffusions of sustainable practices along the value chain has been also fostered by more strategic considerations (Perrini, Vurro 2013). In fact, with company activities spreading over a large number of countries and constituencies the search for new coordination and control systems has become pressing, leading to the formulation and implementation of codes of conduct (Mamic 2005; van Tulder et al. 2009) and collaborative practices aimed at strengthening trust and reduce the potential for unbalanced use of power among firms in the supply chain (Schlegelmich, Öberseder 2007).

As a result, many aspects of the integration of sustainability issues into SCM practices have been analysed over time, starting from the most critical and visible areas of responsibility, that is, the environmental impacts of purchasing decisions and the implementation of green practices (Min, Galle 2001).

Since then, literature on SSCM has been characterized by a progressive broadening of its focus on social and environmental issues related to purchasing and supply, ranging from diversity sourcing (Carter et al. 1999) to procurement policies (Carter 2000; Razzaque, Hwee 2002), labour practices and extended human resource management (Maloni, Brown 2006) through the implementation of code of conducts and other managerial tools (Mamic 2005).

While acknowledging variation in company priorities and orientation to sustainability, these studies have stimulated a growing interest in moving away from inventories of implemented sustainability-related activities toward a deeper understanding of the underlying managerial approaches (Maignan et al. 2002). It is in light of this renewed attention to collaborative governance models of supply chain relationships that most of the recent research has to be interpreted. Still mainly based on qualitative investigations, studies have pointed out to the potential flaws of imposing the adoption of ethical codes of conduct to suppliers, if not with

a comparable shift from arm's length contracting to collaborative practices (Brondoni 2003; Spekman et al. 1998).

Preliminary taxonomies of alternative approaches to SCM have also started to be theorized, elaborating on the beneficial impacts of managerial models based on high levels of cooperation and integration between partners (Drake, Schlachter 2008, Pogutz et al. 2009).

As a whole, the studies on the mechanisms of SSCM implementation tend to share the often prescriptive conclusion that best performers are those able to build and maintain strategic supply chain partnerships, based on long-term cooperation, shared knowledge and joint competence development (Maignan et al. 2002). In this sense, it is through the adoption of relational, collaborative approaches to SCM that companies can succeed in both integrating sustainability practices along the value chain and benefiting from it (Shepherd, Günter 2005).

The review of the literature shows how an interest in investigating the content and impact of collaborative approaches is taking the floor among researchers and practitioners as the strategic option that might lead to more responsible practices in the society and to a more sustainable development. As a consequence, it becomes relevant to answer the following research questions:

> □ *Do firms differ in the extent to which they are involved into collaborative approaches to SSCM? How do these alternative approaches look like? Are there real benefits for firms shifting to collaborative partnerships in both upstream and downstream SCM?*

In fact, despite growing recognition of the potential gains associated to collaboration and transparency in setting shared objectives and strategies, how companies differ in interpreting this new zeitgeist and the related performance consequences both deserve further investigation.

3. Methodology and Empirical Evidence

Pre-testing stage: Given the paucity of research on corporate approaches to SSCM, we performed a preliminary qualitative investigation aimed at identifying different perspectives and setting the basis for the quantitative analysis. The Italian consumer product industry was selected as the locus for case identification, given the relevance of sustainability-related themes as emerging from previous research (Carter, Jennings 2004; Emmelhainz, Adams 1999; Salam 2009). This allowed us to maximize the chance to observe the dynamics under examination (Pettigrew 1990), that is, the differential effects generated through the implementation of alternative SSCM frameworks.

Within the mainframe of consumer product industry and given the need for identifying alternative approaches to SSCM able to explain variability in performance associated to them, sampling was addressed toward the selection of matched pairs of companies, allowing a comparison between similar players involved into different implementation stages of sustainability approaches in the managing of their supply chain (Eisenhardt 1989). Accordingly, two steps were followed to select the cases:

– Identification of sub-context based on the overall relevance of sustainability issues and their pervasiveness in SCM: this step relied on the comparison between preliminary studies conducted on the content of public corporate sustainability (CS) documents released by firms (Perrini et al. 2011), cross-industry reports published by CS institutions and rating agencies (e.g., KPMG, Business&Human Rights Research Center or AccountAbility, Global Reporting Initiative), and existing case studies (e.g., Maloni, Brown 2006; Mamic 2005). Accordingly, matched-pairs were identified in the coffee, apparel and cosmetic sub-contexts. Table 1 summarizes the most relevant supply chain-related dynamics faced by companies in the three sub-contexts.

Table 1: *Current Dynamics in Coffee, Apparel and Cosmetic Supply Chains*

Empirical contexts	Coffee	Apparel	Cosmetic
Sustainability Challenges	Delocalization of production processes in developing countries Disaggregation of production processes and role of intermediaries Human rights and employee health and safety along the chain Gaps between cost price, retail price, and selling price Transparency policies toward the final market Search for quality and innovation in production processes and distribution practices	Pervasiveness of off-shoring, delocalization and sourcing Human rights and employee health and safety along the chain Geographical dispersion in the offering of semi-finished textile products, manufactured products and related services Shift from production-orientation to consumer-orientation to preserve top-tier productions Environmental risks monitoring related to waste management Identification of new target market based on sustainable innovation (e.g., natural and ecologic fiber)	Sustainability integration within research & development processes (green chemistry approach) Environmental impact management in procurement processes for raw materials Socially responsible consumption Safety evaluation of cosmetics

– Selection of matched pairs: three matched pairs were selected based on maximum variation in level of engagement in CS implementation along the value chain and similarity in term of business sector, geographic dispersion, proximity, size and financial performance. Secondary data and information were collected on sustainability issues and supply chain practices for each one of the 6 cases. Data collection was complemented with in depth, semi-structured interviews with informants who could provide rich and insightful information on the dynamics under investigation (i.e., CEOs and managers with direct responsibility for CS or SCM). Each interview was type-recorded and lasted for about two hours. Informants were asked to describe (i) characteristics of, trends and players involved in their supply chain; (ii) existing alternative models for SCM; (iii) company-specific approach to SSCM; (iii) perceived impact areas of SCM approach both on the interaction with suppliers and buyers and on their own performance.

This preliminary investigation, combined with evidence from existing research, served as the basis for developing a close-ended questionnaire constructed to reflect the key perspective emerging from the qualitative analysis. The questionnaire was pre-tested with both academics and practitioners to assess face validity. Any questions that were ambiguous or that did not relate to the construct of interest were reworded or eliminated.

Sample selection and data collection: The research population consisted of 200 companies representative of the Italian consumer product industry. The sampling frame is composed of purchasing managers and executives in consumer product manufacturing who were members listed in the Centromarca Association, 2010, and to whom a questionnaire has been sent via the Internet. Respondents were asked to rate each item on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The final sample included 91 usable responses, representing a response rate of 45.5%. Looking at the composition of the sample, we have 58% of the companies with revenues over than € 100 million. Among the sampled companies, 38% are in the manufacturing industry. Moreover, respondents were top managers (20%) followed by CEOs in about the 14% of the cases and middle managers.

Exploratory factor analysis and regression analysis: In order to investigate the research questions presented in this study, a three-stage analysis has been carried out based on two different methodologies. On the one hand, an exploratory factor analysis has been run in the first two stages of the analysis to identify managerial orientations and performance measures; then, a regression analysis has been used in the last stage. We relied on the statistical software SPSS to perform the analysis. In more detail, throughout a first stage of the analysis, factor analysis has been used to identifying groups of firms with a specific managerial orientation toward SSCM. Starting with 17 variables, we narrowed down to 4 main factors, which we labelled: 1. *proactive*; 2. *sharing*; 3. *interactive*; 4. *inactive*. In the following Table 2, factors identified and variables included in the analysis, and loadings for each variable are presented.[1]

Factors correspond to different approaches to SSCM, which are distinguishable on the basis of specific combinations of the extent to which both collaborative approaches are shared throughout the entire value chain and sustainability issues are explicitly integrated into SCM practices.

Table 2: *Factors Characterizing SSCM Relationships*

	Factor	Questions	Loading
1	Proactive firms	While managing upstream SC relationships, do you run joint processes toward, and/or use technologies aiming at reduce environmental and social impact?	0.87
		While managing upstream SC relationships, do you work on sustainable products?	0.87
		While managing downstream SC relationships, do you work on sustainable products?	0.65
		While managing downstream SC relationships, do you adopt and share certifications and standards (e.g., ethical, social, and environmental codes and certifications)	0.59
		While managing the upstream SC relationships, do you run joint processes toward, and/or use technologies aiming at reduce environmental and social impact?	0.57
		While managing upstream SC relationships, do you adopt and share certifications and standards (e.g., ethical, social, and environmental codes and certifications)	0.42
2	Sharing	While managing downstream SC relationships, do you run joint decision processes toward process innovation?	0.85
		While managing downstream SC relationships, do you use communication and coordination tools?	0.68
		While managing downstream SC relationships, do you run joint decision processes toward product innovation?	0.68
		While managing downstream SC relationships, do you foster local community involvement?	0.64
		While managing upstream SC relationships, do you run joint decision processes toward product innovation?	0.41
3	Inactive	While managing downstream SC relationships, do you take care of customer orientation (e.g., brand loyalty)?	-0.82
		While managing upstream SC relationships, do you control for quality?	-0.73
		While managing upstream SC relationships, do you take care of customer orientation (e.g., brand loyalty)?	-0.54
		While managing downstream SC relationships, do you control for quality?	-0.43
4	Interactive	While managing upstream SC relationships, do you run joint decision processes toward product innovation?	0.82
		While managing upstream SC relationships, do you run joint decision processes toward process innovation?	0.70

- *Inactive companies are those characterized by low orientation toward social and environmental issues and limited attitude to collaboration in SC practices, both upstream and downstream. In this group, traditional arm's length transactions still prevail, with buyers choosing suppliers or distributor for short-term commitments and limited information sharing. Moreover, inactive companies are not willing to spread their customer orientation along the supply chain, thus not recognizing the need for a collaborative strategic orientation while managing their SC relationships. Same considerations rise with reference to quality control, that inactive companies do share neither with their suppliers now with their clients.*

- *Converging on an exclusive focus on the relationships with suppliers (i.e., upstream relationships), interactive companies interpret sustainability in the supply chain as joint decision making aimed at product and process innovation. Though neither implementing specific sustainability-related tools nor addressing the supply chain toward the production of sustainable products and services, interactive companies reveal an alternative approach to SSCM based on joint learning processes with suppliers as the main drivers of sustainability. This turns into a collaborative strategic orientation*

aiming at building a knowledge transfer process among actors. Transferring competence and know-how to relevant stakeholders seems to be the main concern for interactive companies, making it possible to gain and sustain a competitive advantage based, among others, on high quality, skills, and long-term relationships.

- *Sharing companies tend to centre on sustainability in the relationships with distributors (i.e., downstream relationships), interpreting it as a combination of information sharing and joint collaboration practices. As expected, since distributors are not as directly involved into production processes as suppliers can be, joint decision making passes more through the implementation of formal, supportive communication and coordination tools to make the company, the brand or the offer's characteristics more visible to final customers. Sharing companies differ from interactive ones also for a more explicit focus on social issues along the chain, with specific reference to the implementation of local community involvement activities together with distributors.*

- *Despite perceiving the value of joint SC practices, both interactive and sharing companies continue to operate in a market-based context, in which cooperation, long-term relationships and information sharing do not explicitly target sustainability concerns, but aim at reinforcing company performance while maintaining a traditional mind-set. It is not so for proactive companies, who combine cooperative attitude along the entire value chain (i.e., both upstream and downstream relationships) with a strong orientation toward measuring, monitoring and minimizing the social and environmental impacts associated with production and distribution processes. Additionally, proactive companies do not limit themselves to joint impact monitoring, certification and standard sharing but set the basis for sustainable competition within the market, through the joint production and distribution of social, environmental and ethical products.*

In a second stage, we run an additional factor analysis to identify the performance consequences of SSCM practices implemented by Italian consumer product firms. In particular, starting with 15 variables, corresponding to the performance-related items included in the questionnaire, supply-chain related performance measures have been investigated in order to reduce them to two different factors, distinguishing between upstream and downstream relationships. Factors identified and variables included in the analysis, and loadings for each variable are presented in Table 3.[2]

Throughout the last stage of the analysis, an OLS regression model was used to test the research questions presented in this study. Two different models were implemented to investigate the impact of managerial orientations to SSCM on downstream and upstream supply chain performance, each including the independent variables represented by the four factors identified in the first stage. A hierarchical regression procedure was implemented with several control variables in the analysis: industry effect, position of the respondents within the firm, and firm size. Therefore, the control variables were entered into the equation first,

followed by the predictors. We controlled for multicollinearity among all the variables; models presented variance inflation factors (VIF) consistently below the rule-of-thumb cut-off of ten (Neter et al. 1990), thereby providing evidence that multicollinearity among predictors and control variables does not exist.

Table 3: *Factors Characterizing Performance Consequences of SSCM Practices*

	Factor	Questions	Loading
1	Downstream SC-related performance	What are the consequences of downstream SSCM relationships on the following performance areas in your firm?	
		Brand value	0.89
		Traceability	0.86
		Stock availability	0.84
		Delivery dependability	0.80
		Customer loyalty	0.74
		Customer satisfaction	0.71
		Order fulfillment and lead time	0.71
		Production process efficiency	0.70
2	Upstream SC-related performance	What are the consequences of upstream SSCM relationships on the following performance areas in your firm?	
		Time-to-market	0.83
		Customer loyalty	0.81
		Customer satisfaction	0.78
		Order fulfillment and lead time	0.66
		Brand value	0.51
		Stock availability	0.46
		Delivery dependability	0.41

Empirical evidence: Based on descriptive statistics and correlations for the variables, the strongest and most interesting correlates with downstream SSC-related performance are the position of the respondents within the firm ($r = 0.41$), sharing ($r = 0.52$), and inactive firms ($r = 0.52$), which are statistically significant ($p < 0.01$). In particular, the first correlate indicates that top managers recognize a higher impact of the downstream SSC relationships on the performance of the firm. Same considerations emerge for sharing and, surprisingly, inactive firms. On the other hand, the strongest correlates with the upstream SSC-related performance are proactive ($r = 0.41$), inactive ($r = -0.52$) and interactive firms ($r = 0.49$), which are statistically significant ($p < 0.01$). Correlates, therefore, suggest that proactive and interactive firms reveal a higher performance while managing upstream SSC relationships; opposite considerations for inactive firms.

Our second research questions investigates whether there are real benefits in terms of performance for firms shifting to collaborative partnerships in both upstream and downstream SCM. Results suggest very interesting considerations. Analysing the variance explained in our four models, the predictors in our analysis reveal an extremely strong explanatory power (i.e., the adjusted R^2 increase from 17.6% in Model 1 to 50.5% in Model 2; and from -8% in Model 3 to 35% in Model 4).

Looking at the downstream SSC relationships, results provide evidence of a positive statistically significant relationship ($p < .05$) for proactive ($r = 0.32$) and sharing firms ($r = 0.31$). Moreover, results reveal a negative statistically significant relationship ($p < .05$) for inactive firms ($r = -0.31$). Surprisingly, interactive firms

do not experience any effect on their performance while managing downstream SSC relationships.

Shifting to upstream SSC relationships, results reveal a positive statistically significant relationship ($p < .05$) for interactive firms ($r = 0.34$); on the other hand, a negative relationship ($p < .05$) rises for inactive firms ($r = -0.34$). Finally, a positive marginally statistically significant relationship ($p < .10$) is provided for proactive firms ($r = 0.34$).

4. Emerging Issues

Beyond the identification of managerial approaches to SSCM, our study was meant to provide a preliminary empirical validation of their performance consequences, distinguishing between upstream and downstream impacts. Results coming out of the regression analysis show how both collaborativeness and high sustainability orientation along the value chain matter in predicting supply chain-related performance. In fact, with negative impacts associated to inactive SSCM approaches both upstream and downstream, relational governance models and sustainability integration appears as the drivers of a superior ability to provide the right product, at the right time, in the right place and quantity, for the right customers and at the right price (Carter 2005; Drake, Schlachter 2008).

Moreover, empirical evidence points out to the importance of adapting joint processes, collaborative orientation and sustainability-related standards, tools and technologies to the specificities of both upstream and downstream relationships in order to benefit from them. In more details, companies implementing proactive SSCM approaches maximized performance along the whole supply chain through declining activities for and developing collaborative relations with both suppliers and distributors. On the contrary, though conforming to a relational approach to SSCM, companies adopting a narrow focus on collaborativeness along the value chain (i.e., privileging either suppliers or distributors) were able to maximize their performance either upstream or downstream, depending on their primary focus. Generalizing, interactive companies pointing the attention on joint decision processes devoted to product and process innovation are more likely to benefit from collaborative SCM practices together with their suppliers, whereas suppliers have a key role in the production process along the supply chain (Nygaard, Russo 2008). On the other hand, sharing companies combine joint decision processes towards product and process innovation with a higher degree of stakeholder engagement in the relationship with distributors, therefore taking advantage of higher downstream SC-related performance.

In other words, the ability of firms to benefit from sustainability is not merely associated to the development of a generic, corporate-wide attitude to integrating social and environmental issues in supply chain processes and relations among players. Rather it needs to be declined in a way that takes into account the specific characteristics of involved actors (Daboub, Calton 2002; Rasche, Esser 2006; Rowley 1997).

5. Conclusions

With the growing visibility of corporate misconduct in managing boundary-less organizations (Mamic 2005) and an ever-increasing emphasis on the value of relational approaches to business (Daboub, Calton 2002), both research and practice have started to be concerned with the search of innovative approaches to SCM based on more than tracking products and materials' paths throughout the stages of the value chain. In this sense, attention has been progressively addressed to the beneficial impact of implementing social and environmental practices across organizational boundaries, through the establishment of collaborative governance models (Drake, Schlachter 2008; Perrini, Vurro 2006).

With the aim of extending current debate on the need for collaboration along the value chain, our study presented four SSCM approaches, classifying them in terms of breadth of collaborative orientation and explicit integration of social and environmental behaviours and practices in managing upstream and downstream relationships. Moreover the beneficial impacts of combining collaboration and sustainable practices with the development of an ability to adapt them to SC players' specificities have been also shown.

Firms increasingly understand the need to extend sustainable behaviour along the supply chain. Moreover, SSCM should take the form of a collaborative approach among firms, their suppliers and their customers toward human rights, general working conditions and environmental issues. Firms that realize the importance of sustainable strategies should also encourage such behaviour by their partners, that is, the suppliers and customers along the supply chain.

Of course this study has limits as well. First, the analysis suffers of the main limitations related to the use of the questionnaire to collect our data. Most of all, data collected might suffer from the subjectivity of the respondents. Second, the scalability of the results should be tested in contexts other than the consumer industry. That means, our results could provide different conclusions and consideration if transferred to different industries as well as different geographical areas. Therefore, a larger, cross-sector sample should be exploited in order to improve the significance of the findings. Finally, additional emphasis on SSCM and its impact on firm performance should be given distinguishing among different types of firm. A primary distinction should be between small and medium-sized enterprises and large firms (SMEs). Even if large firms are supposed to have more power than do SMEs to influence supply relationships, they do not fully consider disclosing their sustainable strategies to relevant stakeholders such as suppliers and customers along the supply chain.

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Notes

[1] Each variable is drawn from the questionnaire posed to sample firms to identify specific company attitude toward sustainability and collaboration in managing both upstream and downstream relationships along the supply chain. Running the factor analysis, we first checked for multicollinearity among variables. As requested, all the variables in the analysis correlated with each other. We also looked at the determinant of the correlation matrix that was .0000143, greater than the necessary value of .00001. Therefore, we concluded that multicollinearity was not a problem for these data. We also controlled for the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, which was .817, suggesting distinct and reliable factors, and Bartlett's test of sphericity, which was strongly significant ($p < .01$), suggesting that there are relationships between the variables we include in the analysis. Then, looking at screen plots and eigenvalues, we decided to extract four factors, accounting for about 67% of the variance in our research model, but presenting better results than the six factors obtained considering those factors with eigenvalues above the rule of thumb of 1. To make clearer which variables relate to which factors, we decided to choose the direct oblimin method of oblique rotation, since there were good reasons to suppose that the underlying factors could be related in theoretical terms. For example, consider that it would be obvious that firms running joint decision processes toward product and process innovation are also more willing to use technologies aiming at reducing environmental and social impact. While extracting the four factors, we checked for reproduced correlations, with the knowledge that there are 62 (45%) non-redundant residuals with absolute values greater than .05, a good result that illustrates the difference between observed and reproduced correlations in our analysis. Finally, in the above table we reported the loading factors above .4, ignoring the plus or minus sign, obtained in the structure matrix; the same

results were obtained in the pattern matrix, providing evidence of the good results of this analysis.

[2] Similar results emerged related to the factor analysis we run to identify the performance consequences of SSCM. After verified that multicollinearity among variables was not a problem, we controlled for the KMO measure of sampling adequacy and Bartlett's test of sphericity. Once again, we used the direct oblimin method of oblique rotation in light of the potential relationship between the underlying factors. Finally, we reported the loading factors above .4, ignoring the plus or minus sign, obtained in the structure matrix; the same results were obtained in the pattern matrix, providing evidence of the good results of this analysis. In more detail, we extracted two factors with eigenvalues above the rule of thumb of 1, accounting for about 47 percent of the variance in our research model, and including 58 (42%) non-redundant residuals with absolute values greater than .05. Results provide evidence of the consequences respectively of downstream and upstream SSCM relationships on specific performance areas of the firm.