

SUSTAINABILITY IN THE FASHION INDUSTRY: AN IMPORTANT SOURCE OF SUPPLY CHAIN INNOVATION

Antonella Moretto, Politecnico di Milano, Piazza Leonardo da Vinci 32 - 20133 Milano - Italy
antonella.moretto@mail.polimi.it, +39 02 2399 3944

Laura Macchion, University of Padova, Stradella San Nicola 3 - 36100 Vicenza - Italy
macchion@gest.unipd.it, +39 0444 998770

Federico Caniato, Politecnico di Milano, Piazza Leonardo da Vinci 32 - 20133 Milano - Italy
federico.caniato@polimi.it, +39 02 2399 2801

Pamela Danese, University of Padova, Stradella San Nicola 3 - 36100 Vicenza - Italy
pamela.danese@unipd.it, +39 0444 998703

Maria Caridi, Politecnico di Milano, Piazza Leonardo da Vinci 32 - 20133 Milano - Italy
maria.caridi@polimi.it, +39 02 2399 2787

Gianluca Spina, Politecnico di Milano, Piazza Leonardo da Vinci 32 - 20133 Milano - Italy
gianluca.spina@polimi.it, +39 02 2399 2771

Andrea Vinelli, University of Padova, Stradella San Nicola 3 - 36100 Vicenza - Italy
andrea.vinelli@unipd.it, +39 0444 998740

Romano Cappellari, University of Padova, via Ugo Bassi 1 - 35131 Padova - Italy
romano.cappellari@unipd.it, +39 0498 274234

Andrea Sianesi, Politecnico di Milano, Piazza Leonardo da Vinci 32 - 20133 Milano - Italy
andrea.sianese@mail.polimi.it, +39 02 2399 4806

ABSTRACT

The scientific literature about supply chain management has increasingly focused on issues related to sustainability, presenting them as an important source of innovation. This paper aims at understanding how fashion companies could improve their innovation performance, and in particular at assessing the links between the adoption of sustainable (i.e., environmental and social) supply chain practices and the improvement of innovation performance. Through a survey conducted within the most important Italian fashion companies, our research hypotheses about the relationship between company innovation and supply chain sustainability will be tested and analysed.

Keywords: Supply chain management; Sustainability; Innovation; Fashion

1. Introduction

In recent years, the scientific literature about supply chain management (SCM) has increasingly focused on issues related to sustainability. The sustainability concept has been applied to single companies, but more recently it has been extended to the whole supply network (Seuring and Goldbach, 2005). Suppliers, in particular, are one of the main sources of environmental and ethical risks for customer companies, and, at the same time, they can represent one of the main determinants of value creation (Koplin, 2005). Moreover, some authors propose SCM and vertical integration as key issues to achieve a better sustainability, most of all in fragmented supply chains (Carter and Rogers, 2008). The Sustainable Supply Chain Management (SSCM) concept has been introduced to translate into practice the achievement of social, environmental, and economic sustainability goals for improving the long-term economic performance of the individual company and its supply chains (Carter and Rogers, 2008). Since SCM models and sustainability issues might be both affected by different regulations in different industries (Ciliberti et al., 2007) and countries (Sarkis et al., 2010), authors studied the supply chain sustainability issue focusing on a single country in a single industry. From this point of view, the fashion industry is one of the most challenging sector. On the one hand some scandals in the industry have been public for brands such as Nike, Levi Strauss, Benetton, Adidas and C&A (Seuring and Muller, 2008); moreover in the period from 2005 through 2010, the wastes related to clothes and textiles have been estimated to be the fastest growing waste stream, for instance currently amounting to around 2 million tonnes per year in Britain (Defra, 2008). On the other hand the sales of products using organic cotton increased by four times in the period 2006-2009, reaching US\$4.3 billions in 2009 (Organic Exchange, 2010). Such events have increased shareholders' and companies' interests in sustainability at the supply chain level (Seuring and Muller, 2008). The literature is quite rich in identifying the main drivers towards a sustainable approach (e.g., De Brito et al., 2008; Zhu and Sarkis, 2006) as well as the sustainable supply chain practices (e.g. Faisal, 2010; Vermeulen and Ras, 2006). But fewer studies have considered the benefits as well as the performance improvements obtainable through sustainability. Some articles (e.g., Tsoufas and Pappis, 2008) analysed the improvements in terms of sustainable performance (e.g., emissions, wastes, damages for the biodiversity, etc.); other authors have mainly identified the links between the adoption of a sustainability approach and the improvement of firm performance in terms of competitiveness (e.g., Rao and Holt, 2005). But in the fashion industry, product lifecycle is short and differentiation advantages are built on brand image and product styling that can be quickly imitated: this main feature of the industry determines a terrific importance for the innovation performance. For this reason, several authors have deeply investigated the contribution of supply chain to increase innovation for fashion companies, with a special focus on the collaboration with suppliers during the product development activities (e.g., Abecassis-Moedas, 2006), but without considering the role of sustainability in that.

With a wider perspective, in the general sustainability literature some authors have analysed the relationships between sustainability and innovation performance. For example Zhu et al. (2011) have addressed the relevance of sustainability as innovation source. Some authors have mainly analysed the environmental sustainability, showing that this can be considered as a way to achieve higher competitiveness (Hall, 2000). Within this perspective, environmental sustainability is mentioned as a form of supply chain innovation, having all the main characteristics of an innovation, namely relative advantage, compatibility, complexity, trialability and observability (Rogers, 1962). The link between innovation and sustainability is confirmed

also by a study conducted by MIT Sloan Management Review and Boston Consulting Group (Haanaes et al., 2011). Other authors have analysed the corporate social innovation, meaning the improvement of social sustainability to create new market opportunities for companies, aiming at combining corporate social responsibility and company's innovativeness (e.g., Webb, 2007). But in spite of the relevance of these contributions, identification and analysis of possible links between the extent of company's innovation and the adoption of sustainable supply chain practices has not been deeply investigated yet. Moreover, most studies mentioned above are specifically dedicated to either environmental or social sustainability, without considering both the two pillars. According to the state of the art described so far, the objective of this study is to understand how fashion companies could improve their innovation performance, and in particular to assess the links between the adoption of sustainable (i.e., environmental and social) supply chain practices and the improvement of innovation performance. Through a survey conducted within the most important Italian fashion companies, our research hypotheses about the relationship between company innovation and supply chain sustainability will be tested and analysed.

2. Research goal

According to the literature review illustrated so far, the goal of this paper is to analyse the connections between the level of company innovation and the adoption of specific sustainable practices at the supply chain level. Specifically, we aim to understand whether and to what extent supply chain practices influence the innovation performance for fashion companies.

Along the literature vein about sustainability, we aim to identify the contribution that both social and environmental practices can give to increase innovation performance. According to Zhu et al. (2011), who showed that environmental sustainability increases company performance, the first research hypothesis has been formulated.

Hp1: Companies that have introduced supply chain practices to improve their environmental sustainability have better innovation performance.

On the other hand, consistently with the corporate social innovation literature stream (e.g., Webb, 2007), we aim at identifying the contribution of social sustainability to improve innovation performance. According to this, the second research hypothesis has been formulated.

Hp2: Companies that have introduced supply chain practices to improve their social sustainability have better innovation performance.

Finally the literature about SSCM dedicated stronger attention towards environmental sustainability compared to social one (e.g., Zhu et al., 2011; Hall, 2001). According to this consideration, the third research hypothesis has been formulated:

Hp3: The introduction of environmental supply chain practices has stronger influence on innovation performance than social supply chain practices.

3. Methodology

3.1. Sample

In order to investigate the hypotheses, we have collected data through an on-line survey. The sample frame was composed of 406 Italian companies that own at least a brand in property or in license; industry associations as well as direct contacts have been used to identify companies to

include in our sample frame. Survey target respondents have been supply chain managers, operations managers or purchasing managers. The respondents have been contacted by telephone and asked to complete the on-line questionnaire; subsequently non-respondents have been recalled in order to improve the response rate. Once the questionnaire and the identity of sampling units have been defined, we have tested the questionnaire submitting it to colleagues to verify whether the questionnaire accomplishes the study objectives, to industry experts to prevent the inclusion of some obvious questions and to target respondents to collect feedback on everything that can affect answering. The collection phase of questionnaires began in May 2011 through January 2012. Overall, 132 questionnaires have been collected, thus reaching a response rate of about 32%, which is quite high for an in-depth survey in the fashion industry (Ferne and Azuma, 2004). Not all questionnaires were completed and so we decided to include in the subsequent analyses only questionnaires with the sustainability part fulfilled. Overall, the final database used for the analysis consists of 70 companies. In the sample, small companies (up to 50 employees) account for 33% of the sample, medium-size companies (from 50 to 250 employees) account for 40%, while large companies (from 250 employees up) account for 27%. Firms included in the sample operate in the manufacturing industry (ISIC 13, 14, and 15 classification); different product categories have been considered, such as clothing, shoes, bags, accessories, etc.

3.2. Measures

The items of the questionnaire have been identified by literature review as well as by exploratory case studies carried out by the authors in prior research (Forza, 2002). Four categories of variables have been considered for the analysis. The first category of variables concerns sustainable supply chain practices (e.g., Bai and Sarkis, 2010; Chung and Wee, 2008). These variables are used to identify the practices adopted by companies to improve their sustainability. According to the SSCM program (Carter and Rogers, 2008), sustainable supply chain practices cover two areas: environmental supply chain practices and social supply chain practices. Consistently with the literature about collaboration for increasing innovation in the fashion industry (e.g., Abecassis-Moedas, 2006), the second category of variables refers to practices of partnership and collaboration in new product development. In fact, as explained before, collaboration in NPD is a critical level for fashion companies to develop innovative products. The third category of variables pertains to supply chain performance. Due to the research objective mentioned in the previous section, innovation performance has been analysed. Finally, according to the literature vein that sustains the critical role played by contingencies to study sustainability issues (Ilett, 2010; Nagurney and Yu, 2012), the most important control variables proposed by the literature have been included as well. Details about variables are included in Table 1. As shown in the table, most of the variables are measured through a 1 to 5 Likert scale.

Table 1: Variables used in the analysis

<i>Area</i>	<i>Variable</i>	<i>Scale</i>	<i>Average</i>
Sustainable supply chain practices - social	Adoption of social certification	Adoption (1 none – 5 high)	2.32
	Selection of suppliers with social certification	Adoption (1 none – 5 high)	2.57
	Improvement in production process to reduce the impact on	Adoption (1 none – 5 high)	3.27

	employees		
	Training for employees	Adoption (1 none – 5 high)	3.49
Sustainable supply chain practices - environmental	Short supply chain	Adoption (1 none – 5 high)	2.03
	Adoption of environmental certification	Adoption (1 none – 5 high)	1.85
	Ecological point-of-sales	Adoption (1 none – 5 high)	1.87
	Introduction of ecological products	Adoption (1 none – 5 high)	2.23
	Adoption of biologic raw materials	Adoption (1 none – 5 high)	1.85
	Adoption of biologic packaging	Adoption (1 none – 5 high)	2.99
Supply chain operational practices	Long-term collaborations with suppliers	Adoption (1 none – 5 high)	4.23
	Long-term collaborations with retailers	Adoption (1 none – 5 high)	4.24
	Collaboration for new products with suppliers	Adoption (1 none – 5 high)	3.65
	Collaboration for new products with retailers	Adoption (1 none – 5 high)	3.05
Supply chain performance	Product quality	(1 deteriorated – 5 improved)	3.40
	Differentiation from competitors through process innovation	(1 deteriorated – 5 improved)	2.99
	Differentiation from competitors through product innovation	(1 deteriorated – 5 improved)	3.71
Control variables	Size (employees)	Number	1046
	Medium price	Number	857 €
	Level of production in foreign countries	Percentage	43.09%
	Level of distribution in foreign countries	Percentage	24.68%
	Company Age (years)	Number	37

Control variables have been used directly in the analysis, in order to investigate their relationships with supply chain performance. Indeed, in order to increase the reliability and the validity of measures, the variables related to sustainable supply chain practices, supply chain practices, and supply chain performance have been grouped with an exploratory factor analysis. The sustainable supply chain practices were measured through 10 variables, which were grouped in three factors: the supply chain environmental sustainability, which includes practices specifically dedicated to an environmental management of the whole chain; the product environmental sustainability, which includes practices oriented to reduce the environmental impacts of products; the supply chain social sustainability, which includes all the social practices related to the management of the suppliers as well as the employees. The two factors related to

environmental sustainability explains a total variance equal to 65.705% yet the social factor a total variance equal to 62.363%. The supply chain practices were measured through 4 variables, which have been grouped in a single factor that explains the 52.962% of the total variance; a single factor is obtained also for supply chain performance, measure through 4 items, thus explaining 78.136% of the total variance. All the factors identified have Eigen-value higher than 1. The results of the factor analysis are presented in Table 2. The factor scores have been computed with the SPSS regression method and used in subsequent analysis.

Table 2: Exploratory factor analysis (Principal Components Analysis with Varimax Rotation)

Factor	Variable	Factor loading	Cronbach's alpha
Supply chain environmental sustainability	Short supply chain	0.751	0.751
	Adoption of environmental certification	0.763	
	Ecological point-of-sales	0.819	
Product environmental sustainability	Introduction of ecological products	0.793	0.706
	Adoption of biologic raw materials	0.638	
	Adoption of organic packaging	0.852	
Supply chain social sustainability	Adoption of social certification	0.836	0.797
	Selection of suppliers with social certification	0.859	
	Improvement in production process to reduce the impact on employees	0.749	
	Training for employees	0.704	
Collaboration in the supply chain	Long-term collaborations with suppliers	0.785	0.689
	Long-term collaborations with retailers	0.751	
	Collaboration for new products with suppliers	0.749	
	Collaboration for new products with retailers	0.615	
Innovation performance	Product quality	0.922	0.859
	Differentiation from competitors through process innovation	0.916	
	Differentiation from competitors through product innovation	0.809	

Given that all the data have been collected with the same questionnaire and in the same period of time, the extent of common method bias has been assessed using Harman's single-factor test according to Podsakoff et al. (2003). An exploratory factor analysis with all the variables has been performed to determine the number of factors that are necessary to account for the variance in the variables. With the exploratory factor analysis, seven factors are emerged and account for 68.294% of the total variance; the first factor did not account for the majority of the variance (27.482%).

3.3 Data analysis

The data analysis methodology has been selected according to the purpose of the analysis. In particular, a multi-step linear regression model has been used to investigate the relationships between supply chain practices and innovation performance. A first linear regression among on the one hand supply chain performance and on the other hand control variables and supply chain operational practices has been used to identify which elements mentioned in the literature are significant and so to include in the next steps of the analysis. Then, single linear regressions between supply chain innovation and respectively environmental supply chain practices and social supply chain practices have been performed in order to identify the influence of the implementation of sustainable practices related to a single pillar on the innovation performance. Finally, a linear regression among innovation performance and simultaneously social and environmental supply chain practices has been performed. In this case, a step-wise approach has been followed, with the aim of identifying the most relevant sustainability practices in explaining the achievement of innovation performance.

4. Results and discussion

4.1. Results

As described in the previous paragraph, first of all we used a linear regression to identify the significant control variables among the ones mentioned in the literature. Moreover, given the strong literature emphasis on the relevance of collaboration along the supply chain to increase innovation, we tested also the significance of this element. Table 3 shows the results of the linear regression. The model has a R-squared value pair to 0.197 yet an adjusted R-squared pair to 0.105, which could be considered acceptable levels. The results illustrate that none of the control variables is significantly relevant yet the collaboration in the supply chain is relevant, with a $p < 0.05$. According to these preliminary results, just collaboration in the supply chain will be maintained in the next steps of the analysis.

Table 3: Linear regression – relevance of contingent variables and supply chain operational practices

<i>Variables</i>	<i>Standardized coefficients</i>	<i>t</i>	<i>Sig.</i>	<i>Collinearity statistics Tolerance</i>	<i>VIF</i>
Size	0.065	0.510	0.612	0.949	1.053
Medium price	-0.120	-0.910	0.367	0.889	1.125
Level of production in foreign countries	0.017	0.133	898	0.943	1.060
Level of distribution in foreign countries	0.023	0.176	0.861	0.929	1.076
Age	0.092	0.702	0.486	0.898	1.114
Collaboration in the supply chain	0.415	3.123	0.002	0.925	1.081

In order to verify the first research hypothesis, a linear regression between the innovation performance and the implementation of environmental practices has been performed. According to the results obtained in the previous step, the collaboration in the supply chain has been

included as well. Table 4 illustrates the main results of this analysis. This model has a R-squared value equal to 0.274 and an adjusted R-squared pair to 0.233, which are significantly higher than the values of the previous model; this result demonstrates that the model is able to explain a good level of the total variance. The results demonstrate a significant relevance with a $p < 0.05$ for the collaboration in the supply chain as well as supply chain environmental sustainability. These two factors strongly influence the company ability of having good innovation performance, thereby confirming the critical role played by the supply chain to improve innovation performance. Nevertheless, the results do not provide conclusive evidence on the role of product environmental sustainability in improving innovation performance. According to these results, we can argue that the first research hypothesis is validate, given that companies with higher innovation performance have introduced supply chain practices to increase environmental sustainability.

Table 4: Linear regression – relationships between innovation performance and environmental supply chain practices

<i>Variables</i>	<i>Standardized coefficients</i>	<i>t</i>	<i>Sig.</i>	<i>Collinearity statistics</i>	
				<i>Tolerance</i>	<i>VIF</i>
Collaboration in the supply chain	0.296	2.330	0.024	0.849	1.178
Supply chain environmental sustainability	0.258	2.043	0.046	0.862	1.160
Product environmental sustainability	0.221	1.867	0.067	0.981	1.019

Then, in order to test the second research hypothesis, another linear regression has been performed; the goal in this case was to verify the link between the level of innovation performance and the adoption of social practices. In coherence with the previous step, also in this case the collaboration in the supply chain has been included in the model. Table 5 shows the level of significance of each variable of our model. We can address that this new model explain a level of the total variance totally comparable with the previous one (for instance R-squared of 0.273 and adjusted R-squared of 0.247). The results reveal a positive significant influence of both the factors on the innovation performance. As a matter of fact, the supply chain social sustainability is more critical to influence the innovation performance than the collaboration in the supply chain. The selection of certified suppliers and a strong attention to employees' training appear the key issues to increase innovation performance. According to these results, we can argue that the second research hypothesis is validated, given that companies that have introduced supply chain practices to increase social sustainability have obtained higher innovation performance.

Table 5: Linear regression – relationships between innovation performance and social supply chain practices

<i>Variables</i>	<i>Standardized coefficients</i>	<i>t</i>	<i>Sig.</i>	<i>Collinearity statistics</i>	
				<i>Tolerance</i>	<i>VIF</i>
Collaboration in the supply chain	0.290	2.353	0.022	0.857	1.167
Supply chain social sustainability	0.339	2.757	0.008	0.857	1.167

Finally, the research hypothesis 3 has been verified through a step-wise linear regression. The aim was to identify which elements are more critical in influencing innovation performance among social and environmental supply chain practices. Indeed, also in this case the collaboration in the supply chain has been included in our model. Table 6 illustrates the main results, presenting first of all the level of significance for relevant variables and then the results for excluded variables. This model explains the same level of variance of the previous one. The results exhibit that the two most critical variables are the supply chain social sustainability and the collaboration in the supply chain; on the contrary to our expectations, the environmental sustainability practices have been excluded, resulting less relevant than the previous ones in influencing innovation performance. According to these results, we can argue that the third research hypothesis is not supported by the data.

Table 6: Linear regression – relationships between innovation performance and sustainable practices

<i>Variables</i>	<i>Standardized coefficients</i>	<i>t</i>	<i>Sig.</i>	<i>Collinearity statistics</i>	
				<i>Tolerance</i>	<i>VIF</i>
Collaboration in the supply chain	0.290	2.311	0.025	0.857	1.167
Supply chain social sustainability	0.339	2.707	0.009	0.857	1.167
<i>Excluded variables</i>	<i>Beta In</i>	<i>t</i>	<i>Sig.</i>	<i>Collinearity statistics</i>	
				<i>Tolerance</i>	<i>VIF</i>
Supply chain environmental sustainability	0.064	0.406	0.687	0.553	1809
Product environmental sustainability	0.129	1.058	0.295	0.909	1.100

4.2. Discussion

The data analysis leads us to formulate some considerations about the role played by sustainability to improve innovation performance. First of all, we can argue that actually the implementation of sustainable supply chain practices is a key determinant to increase the company's innovation level, consistently with the thesis of Zhu et al. (2011). The data address the strong importance of introducing either environmental supply chain practices or social supply chain practices to increase innovation performance. In case of specific attention to environmental sustainability, the data analyses recommend a stronger attention to supply chain-oriented practices in spite of product-oriented ones; this result subsides the literature contributions sustaining the importance of a supply chain attention to handle sustainability (e.g., Seuring and Goldbach, 2005). But, comparing social to environmental practices, the social supply chain

practices appear more effective and meaningful. This outcome points out the strong weight of both suppliers and internal employees to increase innovation at the process as well as at the product level. Besides sustainability issues, it is worth discussing that a valuable factor for innovation is the collaboration along the supply chain as suggested by previous literature (e.g., Abecassis-Moedas, 2006): in all the models, the collaboration is effectively significant. In such wise, it is worth mentioning that the collaboration along the supply chain, with both suppliers and retailers, is an inescapable matter for companies of this industry, especially with an orientation to product development and with a long-term horizon. These two results (i.e., significant relevance of social and collaboration practices) could be strictly tied to the characteristics of the Italian fashion industry. Substantially the Italian industry is composed of several small and medium companies, whose suppliers are from small to very small; moreover, suppliers are often responsible for all the production activities. This industry composition makes the control as well as the collaboration with the external suppliers essential to guarantee both their survival and the required quality level. Finally, we can also argue that no control variables identified through the literature review are significant to discriminate among different level of innovativeness; this result is valuable especially for size, being this variable mentioned in the literature as an important element to differentiate among discordant innovation behaviours.

5. Conclusions

This study analyses on an empirical basis the relationships between the adoption of sustainability practices and the innovativeness level of Italian fashion companies. The first relevant conclusion emerging from the study is the critical function of sustainability to increase innovation performance; in particular, the social supply chain sustainability is more effective than environmental supply chain sustainability and also than the collaboration along the supply chain. Moreover, the results point out the supply chain influence on innovation performance, with both the collaboration and the sustainability perspective. We maintain these results are relevant for research, since very few authors have investigated the relationships between sustainability and innovation performance as well as have contextually considered both social and environmental sustainability. Moreover, the emerging results are meaningful also for practitioners, being innovation and sustainability critical issues for fashion companies today. Practitioners, thanks to this work, can identify an additional way to improve their innovation performance as well as an alternative trigger to implement sustainable programs into their firms. The main limitation of this work consists in the small survey dimension: future editions of the survey will aim to increase the sample size, maybe through the introduction of additional countries to allow cross-country comparisons. Moreover, future editions will allow the development of longitudinal analysis, a critical point to increase the knowledge about recent topics such as sustainability. Finally, this research opens doors to further investigations. Indeed, additional performance should be considered, such as cost or time; this would be helpful to investigate also the existence of synergies as well as trade-offs among different performance indicators.

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