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Improving innovation performance through environmental practices in the fashion industry: the moderating effect of internationalisation and the influence of collaboration

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ABSTRACT

In recent years, the scientific literature on supply chain management has increasingly debated on environmental sustainability as well as collaboration, presenting these issues as an important source of innovation along the supply chain. By combining literature streams on environmental sustainability, supply chain collaboration and innovation at the supply chain level, this paper aims to analyse whether the adoption of environmental sustainability practices and collaboration along the supply chain implies better innovation performance, in terms of differentiation from the competitors for higher quality, product or process. The paper also investigates whether the internationalisation, in terms of both production and distribution activities, negatively moderates this relationship. The study focuses on the fashion industry, and a survey of major Italian fashion companies was conducted. The main results of the research clearly show the positive impact of these practices on innovation performance. The paper also proves the existence of a moderating effect exerted by internationalisation on the relationship between environmental sustainability and innovation performance.

1. Introduction

In recent years, the literature on supply chain management (SCM) has increasingly investigated sustainability issues, extending them to the entire supply network (Seuring and Goldbach 2005; Garetti and Taisch 2012; Barber, Beach, and Zolkiewski 2012).

Since SCM and sustainability issues may be affected by different regulations in different industries and countries, the literature suggests focusing on a single industry in a single country (Ciliberti, Pontrandolfo, and Scozzi 2008; Sarkis, Gonzalez-Torre, and Adenso-Diaz 2010). From this perspective, the fashion industry is one of the most challenging sectors (Caniato et al. 2011). Indeed, industry scandals related to sustainability have produced negative publicity for brands such as Nike, Levi Strauss, Benetton and Adidas (Seuring and Müller 2008). Waste related to clothes and textiles is estimated to be the fastest growing type of waste globally (approximately two million tonnes per year in Britain alone, during the period 2005–2010) (Defra 2008). Since 2011, Greenpeace's campaigns have revealed the extent of the pollution produced by textile production and laundry, targeting almost all major brands. The sales of products using organic cotton increased fourfold during the period from 2006 to 2009, however, reaching US$4.3 billion in 2009 (Organic Exchange 2010). Such events have increased the interest of companies in sustainability

at the supply chain (SC) level (Seuring and Müller 2008; Fernando and Almeida 2012).

The literature is quite rich in its identification of the main drivers of a sustainable approach (Zhu and Sarkis 2006; de Brito, Carbone, and Blanquart 2008), as well as sustainable SC practices (Vermeulen and Ras 2006; Faisal 2010), however, further studies are required to better identify sustainability benefits, not considering only either environmental (e.g. Tsoulfas and Pappis 2008; Cheah et al. 2013) or economic (Rao and Holt 2005; Wu and Pagell 2011; Boons et al. 2013) performance.

In the fashion industry, in fact, the product life cycle is short, and differentiation advantages are built on brand image and product style, which can be quickly imitated, determining the prime importance of considering other types of performance, such as innovation (Bruce and Daly 2011) in particular in relation to the sustainability issue (Zhu, Sarkis, and Lai 2012b). Thus far, authors have mainly analysed environmental sustainability, showing that it can be considered a way to achieve higher competitiveness in terms of product and process differentiation from competitors (Hall 2000; Haanaes et al. 2011). Despite the relevance of these contributions, possible links between the extent of a company's innovation and the adoption of sustainable SC practices have not yet been analysed thoroughly, in particular in the fashion industry. Because of the relevance of innovation and

sustainability, and considering the importance that innovation holds in the fashion industry, further studies in this sector are necessary. We decided to consider innovation with the specific definition of the capability to differentiate from competitors through outstanding quality or through the improvement either at the product or at the process level (Hristov and Reynolds 2015).

Moreover, the fashion industry has been clearly demonstrated to be an international industry; companies are necessarily required to operate in international contexts from both a production and a distribution perspective (MacCarthy and Jayarathne 2013) and the literature addresses the fact that sustainability issues are very often related to internationalisation because the level of internationalisation could modify the results obtained through sustainable practices. For this reason, we intend to study not only whether the implementation of sustainable SC practices can influence a company's innovation performance but also whether the level of internationalisation influences this relationship, having a moderator effect.

Finally, the literature addresses the pivotal role of collaboration to improve the innovation of products (e.g. Petersen, Handfield, and Ragatz 2005) in particular in sustainability programmes (Hallstedt, Thompson, and Lindahl 2013) and within the fashion, since fashion supply networks are highly characterised by many and different partners dealing with different production phases (Jacobs 2006). In fact, collaboration in NPD is a critical method with which fashion companies can develop innovative products (Seuring and Müller 2008; Vachon and Klassen 2008). For these reasons, the role of collaboration for improving innovation performance has also been examined.

Based on the literature gaps, this paper would aim at addressing whether sustainability practices and collaboration would improve company's innovation performance; moreover, the paper aims at addressing whether (production and distribution) internationalisation would moderate this relationship.

To test our hypotheses, we used a survey-based methodology involving the most important Italian fashion companies.

2. Literature review and research hypotheses

2.1. Sustainability and environmental practices in the fashion industry

The fashion industry is becoming highly sensitive to sustainability issues and in particular to environmental ones. For example, Norm Thompson Outfitters – a catalogue retailer – has incorporated sustainability principles since the 1990s (Marshall and Brown 2003); Patagonia decided during the 1990s to use only organic cotton for the production of fashion products (Caniato et al. 2011); Nike recently involved its partners in sustainability action plans (Fromartz 2009); Kering Group has defined quantifiable targets not only to improve the environmental side of their companies but also to evaluate their key suppliers using a code of conduct (Kering Group 2014).

These phenomena, closely related to the increasing sustainable preferences expressed by final consumers in recent years, are forcing companies to consider features that go beyond just style or price (Søndergård, Hansen, and Holm 2004; de Brito, Carbone, and Blanquart 2008; Faisal 2010). Although these are not traditional core activities for fashion companies, they have a considerable impact on the competitiveness of the entire SC and therefore require proper management involving all SC partners (Faisal 2010).

The literature suggests an integrated approach to face environmental issues, by considering not only the practices of focal companies but also studying the actions within entire supply networks. Ellram, Tate, and Carter (2007) identified two important groups of environmental practices to implement: not only product practices but also supply chain practices, related to the supply chain choices from the suppliers to the point of sales. Indeed, first contributions have discussed practices that may be used to improve sustainability from a product point of view, such as the use of organic fibres, and assessed the technological elements required to produce such products (Caniato et al. 2011). Then environmental management has evolved, highlighting the importance of considering a sustainable supply chain perspective. Different contributions deepened the issue of supplier selection (in terms of certified suppliers and closed suppliers) in order to enhance sustainable supply chain practices (e.g. Caniato et al. 2011) and included in their analysis important supply chain activities such as the purchase of green components, raw materials and packaging that should be toxic-free, recyclable, renewable and possibly sourced from sustainable sources (Vachon and Klassen 2008). According to this dualistic perspective, both proper product and process certification (such as Carbon Footprint, Ecolabel, Oeko-tex 100, Global Reporting Initiative, ISO 14000 or Global Organic Textile Standards) have been developed by companies to guarantee the environmental sustainability profile of their entire SC (de Brito, Carbone, and Blanquart 2008; Caniato et al. 2011; van Bommel 2011). SC green labels and certifications have experienced widespread large diffusion in recent years, to eliminate pollution sources and hazardous chemicals through structured programmes (van Bommel 2011).

2.2. Innovation and the influence of environmental sustainability on it

Many authors have debated the proper formalisation of the innovation construct: some measure innovation performance by the share in total sales ascribed to new-to-the-world products (e.g. Laursen and Salter 2006); some describe it with technical aspects such as the development of new technologies into new products for improving product quality (e.g. Chen and Huang 2009); still other consider a more process-oriented perspective, investigating how technologies can support the process redesign and the implementation of different production strategies, to bring about major and radical change (Davenport 2013). Despite these considerations, innovation remains a controversial construct that involves different elements related to product and process improvements, but that is unquestionably connected to a company's ability to differentiate itself from competitors (Atuahene-Gima 1996; van Bommel 2011; Hallstedt, Thompson, and Lindahl 2013; Hristov and Reynolds 2015; Theyel and Hofmann 2015).

Moreover, a growing literature is seeking to connect the innovation issue to the sustainability perspective (Haanaes et al. 2011; Adams et al. 2015). Zhu, Sarkis, and Lai (2012b) present a specific theory for environmental innovation (i.e. the Ecological Modernization Theory, EMT), which may provide some insights

to help solve the conflict between industrial innovation and environmental protection. They demonstrated that companies could achieve different levels of innovation performance improvements depending on their level of adoption of green SC practices. By adopting sustainable actions, companies can improve the innovative profile of their products and processes and achieve greater competitiveness and in this way sustainability is considered a valuable means of innovation (Hall 2000; Adams et al. 2015).

Fashion companies in particular should carefully consider the link between environmental sustainability practices and innovation performance since many authors highlight the critical role that innovation plays for fashion companies (e.g. Cappetta, Cillo, and Ponti 2006), and stress the importance of monitoring innovation performance (Nidumolu, Prahalad, and Rangaswami 2009; Theyel and Hofmann 2015). In this industry, sustainability practices have to be considered and introduced starting from collection definition (i.e. when the number of items, colours, moods of a collection are defined as well as the main features), because this will directly affect how the product will be realised; by doing so, it could be easier to reduce the environmental impact of product during their life cycle and at the same time the level of innovation of both product (through for instance the selection of new green materials) and process (through for instance the development of new processes that allow compliance with new environmental requirements) can increase (Hallstedt, Thompson, and Lindahl 2013). Patagonia is one of the first companies that have since long understood the importance of the combination of environmental sustainability and innovation and is one of the best example of a company that decided to move towards sustainability with the purpose of improving innovation declined in terms of product quality, as well as process differentiation from competitors (Caniato et al. 2011).

Although the literature is thus quite rich in presenting the links between sustainability and innovation, this topic is still under-investigated, especially in the fashion industry. Further study in this industry is necessary to identify the benefits as well as the innovation performance improvements that can be obtained through sustainability. Following Ellram, Tate, and Carter (2007), we considered both product practices and supply chain practices as environmental practices to be studied in relation to innovation performance.

H.1: The adoption of environmental practices (product and supply chain practices) increases innovation performance in fashion companies.

2.3. The relationship between internationalisation and sustainability in the fashion industry

Nowadays fashion companies purchase and produce from suppliers and subcontractors located in very different parts of the world and sell in widespread markets with different approaches to sustainability issues. Globalisation has accelerated in recent decades, determining the need for a complex international reorganisation within the fashion industry (Buxey 2005; Wu 2011; Caniato et al. 2015) and assumed an important role in the achievement of sustainability as well (Faisal 2010). Many authors have highlighted the complexity of sustainable development when applied internationally, mainly because a sustainable

development is culturally rooted (e.g. Husted and Allen 2006; van Bommel 2011). Literature hosts a growing debate on the interaction between internationalisation (of distribution and production activities) and sustainability (Faisal 2010; Nagurney and Yu 2012): it suggests that challenges due to internationalisation often arise when companies in the fashion industry want to improve their sustainability. Zhu, Sarkis, and Lai (2012a) studied the Chinese case in order to understand whether globalisation damages the sustainable profile of companies: different approaches to environmental impact are adopted in the world (e.g. in Europe or Asia), although Asian countries are nowadays making serious efforts to overcome environmental sustainability problems (Zhu, Sarkis, and Lai 2012a, 2012b). Zhu, Sarkis, and Lai (2012b) focused more closely on the impact of globalisation on sustainability; Vermeulen and Ras (2006) illustrated the difficulties faced by two Dutch fashion companies in 'greening' their global fashion SC; Faisal (2010) described the case of a shoe producer, finding that an Indian supplier was unwilling to engage in sustainability assessment.

Many contributions have therefore highlighted the importance of studying the environmental sustainability issue in relation to internationalization, but authors only particularly emphasised the difficulties for sustainable companies to achieve good performance in a global SC (Zhu, Sarkis, and Lai 2008), because of the potential environmental problems resulting from worldwide distribution and production activities (Nagurney and Yu 2012). For instance, small delivery lot sizes, arising from increasingly shorter fashion collection times, are increasing the number of shipments, thus raising the environmental impact in the entire SC (Faisal 2010). Additional research is thus necessary for the fashion industry, given the high level of globalisation of both production and distribution processes beyond national boundaries (Buxey 2005; MacCarthy and Jayarathne 2013; Macchion et al. 2015), in spite of missing research about the link between sustainability and innovation in international distributive and productive contexts. Only the contribution of Cainelli, Mazzanti, and Montresor (2012) studied the link between environmental sustainability, innovation and internationalisation, however without focusing within the fashion industry. Accordingly to the available literature, the internationalisation seems to enhance the problem of achieving high innovation performance for companies implementing environmental practices and on the basis of these arguments, we can put forward the following hypothesis.

H.2.1: The level of distribution in foreign countries negatively moderates the relationship between environmental practices (product and supply chain practices) and innovation performance in the fashion industry.

H.2.2: The level of production in foreign countries negatively moderates the relationship between environmental practices (product and supply chain practices) and innovation performance in the fashion industry.

2.4. Innovation and the influence of collaboration on it

The analysis of innovation performance for fashion companies cannot exclude the relevance of collaboration along the supply chain. In fact collaboration between partners is considered a crucial aspect, in particular for companies of the fashion industry
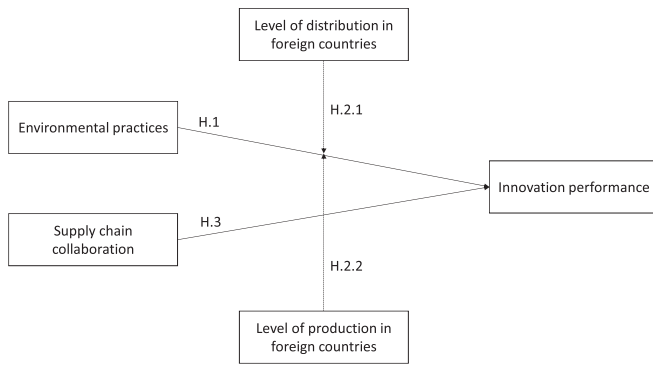
Figure 1. Research hypotheses.

(Abecassis-Moedas 2006; Faisal 2010), since fashion supply networks are highly fragmented and characterised by many and different partners (Jacobs 2006).

Collaboration can be described as an inter-organisational relationship type in which the participating parties agree to invest resources, mutually achieve goals, share information and responsibilities as well as jointly make decisions and solve problems (Soosay, Hyland, and Ferrer 2008). In fact collaboration among partners has shifted market competition from that between single companies to that between networks of firms (van Bommel 2011), in which the focal company is responsible for the environmental improvements of their partners (Seuring and Müller 2008). Collaboration is based on mutual trust and openness: two or more partners share resources, knowledge and capabilities with the objective of establishing a long-term relationships that yield a competitive advantage, resulting in better performance (Soosay, Hyland, and Ferrer 2008).

About innovation, literature have underlined an improvement, facilitated by long-term collaboration with supply chain partners (of both supply or distribution) (Soosay, Hyland, and Ferrer 2008), and by joint programmes in the New Product Development (NPD) area (Bunduchi 2013). Several studies have shown that a higher involvement of supply network partners in the early NPD phases is highly beneficial in terms of innovations in product quality and processes (Zhu and Sarkis 2004; Petersen, Handfield, and Ragatz 2005; Seuring and Müller 2008; Vachon and Klassen 2008; van Bommel 2011; Hallstedt, Thompson, and Lindahl 2013). Moreover the literature provides support for the fact that an organisation with a proactive approach to collaboration with all supply chain partners will develop more successful and innovative solutions (Soosay, Hyland, and Ferrer 2008; Vachon and Klassen 2008). Strong inter-firm links, both with suppliers and distributors, could in this way improve the competitiveness of the entire supply network (Vachon and Klassen 2008; Faisal 2010). This is much more valid if an international perspective would be considered, since internalisation accentuates and enhances the challenges to improving innovation performance, especially in industries with a high presence of Small and Medium Enterprises, such as the fashion one (Tan, Smith, and Saad 2006).

For these reasons, collaboration was included in the model, with the goal of also understanding the impact of collaboration on innovation performance as well.

H.3: Collaboration along the value chain is positively linked to innovation performance in the fashion industry.

Figure 1 shows the research hypotheses presented above.

3. Methodology

3.1. Sample selection

This research is based on a web survey (Forza 2002) that we designed and administered. The sample included Italian fashion companies that owned at least one brand in property or license, and that developed at least two collections per year for consumer markets. We considered firms operating in the clothing, eyewear, footwear and leather industries, but excluded firms that specialise in the production of fabrics or in the industrialisation and production of clothes on a job-order basis.

We contacted 406 Italian fashion companies (selected based on a random sampling method) that represented a relevant portion of the Italian fashion company population (Cillo, De Luca, and Troilo 2010). To ensure that adequate questionnaires were available for the analysis, incomplete questionnaires were either completed with additional calls with the company, or discarded. Authors decided to keep in the final sample just the answers quite well complete (i.e. more than 80% of the answers were usable), so that the data were considered sufficient for studying phenomena in the industry (Tsikriktsis 2005).

A total response rate of 32% was achieved (i.e. 132 questionnaires), which is a fairly high percentage for an in-depth survey in the fashion industry. Due to missing data for several key-items, 7 questionnaires were deemed unusable, resulting in a final sample of 125. The sample is composed of companies that belong to the clothing (58%) and accessories (eyewear, footwear and leather) (42%) industries; most of the companies were performing a total look approach, thereby including both clothing and accessories in their product range, but they were required to indicate their main product category. This sample is a good representation of the Italian fashion system: similar sample size has been used in previous study of the Italian fashion industry (e.g. Cillo, De Luca, and Troilo 2010) as well as in practitioner industry analysis (e.g. Area Studi Mediobanca 2015). This sample size is consistent with suggestions provided by Bartlett, Kotrlik, and Higgins (2001) for the optimal sample size, depending on the population size (450 companies), margin of error and type of data; and by Hatcher (1994) about using a sample size equal to five times the variables considered or at least 100 observations in case of factor analysis. Thirty-three per cent of the companies surveyed were small (revenues ≤ €10 m), 40% were medium-sized (revenues from €10 m to €50 m) and 27% were large (revenues > €50 m). Twelve percentage were very large companies, with revenues higher than €250 m. In terms of employees, 31.7% of the companies had fewer than 50 employees, 40.8% had between 50 and 250 and 27.5% had more than 250 employees.

To check for response bias, we compared responses to a randomly selected subset of questions obtained during an early and a late stage of data collection (Lambert and Harrington 1990). No significant differences were noted.

3.2. Data collection

The items on the questionnaire were selected through the literature review, as well as the exploratory case studies we undertook during prior research (Forza 2002). In formulating the questions, we paid particular attention to verifying that the language of the questionnaire was easy to understand and consistent with

Table 1. Confirmatory factor analysis (constructs and reliability indicators).

Factor	Variable	Factor loading	Cronbach's α	AVE	CR
Environmental practices – supply chain practices	Short supply chain	0.831	0.751	0.484	0.733
	Adoption of environmental certification	0.666			
	Ecological point of sales	0.564			
Environmental practices – product practices	Introduction of ecological products	0.849	0.706	0.506	0.751
	Adoption of green raw materials	0.600			
	Adoption of green packaging	0.660			
Supply chain collaboration practices	Long-term collaborations with suppliers	0.739	0.689	0.423	0.742
	Long-term collaborations with retailers	0.719			
	Collaboration for the creation of new products with suppliers	0.587			
	Collaboration for the creation of new products with retailers	0.531			
Innovation performance	Differentiation from competitors through outstanding product quality	0.907	0.859	0.682	0.864
	Differentiation from competitors through process improvement	0.866			
	Differentiation from competitors through product improvement	0.686			

the respondents' business lexicon. Once the questionnaire was defined, we tested for content validity by consulting with colleagues, industry experts and target respondents.

The survey target respondents were SC, operations or purchasing managers who were contacted by telephone. The respondents were then asked to complete the online questionnaire. The non-responding companies were contacted by phone a second time to improve the response rate. We asked the respondents to identify and report on their main brand and product in terms of company sales and to provide their answers on the questionnaire with reference to this product/brand.

3.3. Variables

A total of 15 survey items (shown in Appendix 1) were used to measure independent, dependent and moderating variables in this study, as explained in the following sections.

Independent variables are, first of all, environmental practices – split into supply chain-related and product-related – and were selected on the basis of the literature review (Ellram, Tate, and Carter 2007; de Brito, Carbone, and Blanquart 2008; Faisal 2010; van Bommel 2011). Another independent variable pertains to collaboration: we considered four independent variables involving practices of partnership and collaboration in NPD, with both suppliers and retailers (Abecassis-Moedas 2006; Faisal 2010). These variables were measured using 10 items on a 5-point Likert scale; managers were asked to address the adoption level for each individual practice.

The dependent variables pertain to innovation performance. In this paper, innovation was measured using three items addressing the ability of companies to differentiate themselves from competitors, by considering the product quality, the product improvement and process improvement (van Bommel 2011; Hallstedt, Thompson, and Lindahl 2013; Hristov and Reynolds 2015). These items were measured using a five-point Likert scale; managers were asked to indicate their perceptions of the improvement in the specific performance in the previous year.

Finally, for our purpose of analysing the impact of sustainability on innovation performance in an international context, two variables that may moderate this relationship were considered: the percentage of turnover realised outside Italy and the

percentage of production value performed in foreign countries. The foreign countries and areas considered in our analysis were China, India, Turkey, western Europe, eastern Europe, North Africa, the Middle East, the Far East, North America, Central/South America, Russia and others. Managers were asked to identify the percentage of distribution and production in Italy in each foreign country considered.

3.4. Measures

To increase the reliability and validity of the measures, judgemental variables, environmental sustainability and SC collaboration practices (independent variables) and performance (dependent variables), were grouped using a confirmatory factor analysis (Table 1), consistently with the indications from the literature analysis. Each factor is composed of at least three items with loadings greater than 0.6 and eigenvalues higher than 1. Table 1 suggests that AVE and CR are above the specified lower value, except for supply chain collaboration practices, whose AVE is slightly below 0.5.

The six variables measuring environmental practices (independent variables) were grouped into two factors of three items, consistent with the existing literature (Ellram, Tate, and Carter 2007; Faisal 2010; Caniato et al. 2011). Some fashion companies adopted well-defined SC environmental programmes, developing, for instance, specific guidelines, codes of conduct or certification schemes; other companies adopted more product-oriented environmental actions (Faisal 2010). The factors are:

- Supply chain environmental practices, which include practices dedicated specifically to the environmental management of the entire chain.
- Product environmental practices, which include practices oriented to reducing the environmental impact of products.

The four variables measuring SC collaboration practices were grouped into a single factor that includes collaboration with both suppliers and retailers. A single factor for innovation performance was also obtained.

All the factors identified have a Cronbach's alpha greater than 0.65 (Nunnally 1978). Standardised factors were used for all the items and in subsequent analysis.

Table 2. Hierarchical linear regression – impact of practices on innovation performance and level of distribution in foreign countries.

	Main effects	Interaction effect	
	Model 1	Model 2	Model 3
Supply chain environmental sustainability (SCEn)	0.296 (0.297)**	0.735 (0.738)***	0.847 (0.850)***
Product environmental sustainability (PDEn)	0.297 (0.295)**	0.286 (0.283)**	−0.049 (−0.049)
Supply chain collaboration	0.295 (0.295)**	0.240 (0.240)*	0.262 (0.262)*
Level of distribution in foreign countries (ID)	−0.118 (−0.038)	−0.116 (−0.037)	−0.116 (−0.037)
ID*SCEn		−0.788 (−0.484)*	−0.970 (−0.596)**
ID*PDEn			0.726 (0.401)*
R^2	0.345	0.400	0.672
Adjusted R^2	0.284	0.329	0.371

Notes: The values reported are unstandardised regression coefficients; standardised coefficients are in parentheses.
*p-value < 0.1; **p-value < 0.05; ***p-value < 0.01.

Table 3. Hierarchical linear regression – impact practices on innovation performance and level of production in foreign countries.

	Main effects	Interaction effect	
	Model 1	Model 2	Model 3
Supply chain environmental sustainability (SCEn)	0.306 (0.307)**	0.247 (0.248)	0.215 (0.216)
Product environmental sustainability (PDEn)	0.289 (0.286)**	0.294 (0.292)**	0.665 (0.659)***
Supply chain collaboration	0.292 (0.292)**	0.290 (0.289)**	0.303 (0.303)**
Level of production in foreign countries (IP)	0.333 (0.134)	0.325 (0.131)	0.402 (0.162)
IP*SCEn		0.160 (0.460)	0.178 (0.088)
IP*PDEn			−0.759 (−0.436)**
R^2	0.361	0.364	0.416
Adjusted R^2	0.312	0.302	0.346

Notes: The values reported are unstandardised regression coefficients; standardised coefficients are in parentheses.
*p-value < 0.1 **p-value < 0.05; ***p-value < 0.01.

Given that all the data were collected using the same questionnaire and during the same period of time, we attempted to limit the risk of common method bias by asking for objective figures (such as those used for internationalisation). Questions measuring dependent variables and those measuring independent variables were also located in different sections of the survey. The extent of common method bias has been assessed using Harman's single-factor test in accordance with Podsakoff et al. (2003). An exploratory factor analysis with all of the variables was performed, and a single factor accounts only for 27.5% of the total variance.

3.5. Model testing

A hierarchical linear regression model was used to investigate the relationships between sustainable practices, collaboration and innovation performance, as suggested by Baron and Kenny (1986). We selected a hierarchical linear regression model

because a scatterplot analysis of the data suggests a linear and additive relationship between variables.

This study is intended to examine also whether the internationalisation level, in terms of both production and distribution, negatively moderates the relationship between sustainable practices and innovation performance. The achievement of this goal requires the analysis of moderating relationships. In particular, three models were tested: the main independent variables (SC environmental sustainability, product environmental sustainability, SC collaboration and SC internationalisation) were introduced as blocks, followed by each interaction term, entered individually (Danese and Filippini 2010). If the b-coefficient of the interaction term is statistically significant and the R^2 increases when this term is introduced in the model, the existence of a moderating effect is proven (Jaccard and Turrisi 2003).

4. Results

4.1. The impact of environmental and collaboration practices on innovation performance

We first analysed the impact of environmental practices on innovation performance. Both SC practices and product environmental practices have a positive and significant impact on the improvement of innovation performance (as shown in Tables 2 and 3, in both the case of international distribution and international production analysis). This result allows us to accept H.1.

Then, we assessed the impact of supply chain collaboration on innovation performance. An incisive effect of collaboration on performance was identified, and is shown in Tables 2 and 3. This result allows us to accept H.3. as well.

4.1.1. The moderating role of distribution in foreign countries in the impact of environmental practices on innovation performance

First, we ran a regression to test whether the internationalisation of the distribution network negatively moderates the relationship between the adoption of environmental practices and innovation performance (Table 2). By adding the moderating elements, we can see that a moderating effect actually exists, given that there is an improvement in the adjusted R^2 (from 0.284 in Model 1 to 0.371 in Model 3), in addition to the significance of the interaction factors.

In particular, we found that distribution in foreign countries has a significant negative moderating impact on SC environmental sustainability. H2.1 is thus accepted, concerning supply chain environmental practices. Conversely, distribution in foreign countries has a positive, significant moderating effect on the impact of product environmental practices on innovation performance. According to these insights, we can conclude that H2.1 is rejected concerning product environmental practices, because a moderating impact exists but with a positive influence.

4.1.2. The moderating role of production in foreign countries on the impact of environmental practices on innovation performance

We subsequently ran a regression to test whether the internationalisation of the production network moderates the relationship between the adoption of environmental practices

Table 4. Result synthesis.

Hypothesis number	Hypothesis	Result
H.1	The adoption of environmental practices (product and supply chain practices) increases innovation performance for fashion companies.	ACCEPTED
H.2.1	The level of distribution in foreign countries negatively moderates the relationship between environmental practices (product and supply chain practices) and innovation performance in the fashion industry	ACCEPTED for SC environmental practices REJECTED for product environmental practices (positive moderation)
H.2.2	The level of production in foreign countries negatively moderates the relationship between environmental practices (product and supply chain practices) and innovation performance in the fashion industry	REJECTED for SC environmental practices (no moderation) ACCEPTED for product environmental practices
H.3	Collaboration along the value chain is positively linked to innovation performance in the fashion industry	ACCEPTED

and innovation performance (Table 3). The results show that the moderating effect is only partially significant. We can see an improvement in the adjusted R^2 among the three models, although the improvement is quite small (from 0.312 in Model 1 to 0.346 in Model 3 reported in Table 3). In Model 2 adjusted R^2 is lower than in Model 1 (0.312 vs 0.302), which shows that the level of production in foreign countries does not moderate the relationship between SC environmental practices and innovation performance. This suggestion is confirmed by the lack of significance of both SC sustainability practices and the moderator in Model 2. Thus, H2.2 related to SC environmental practices is rejected.

Conversely, the level of production in foreign countries negatively moderates the impact of product environmental practices on innovation performance. Thus, H2.2 for concerning product environmental practices is accepted.

5. Discussion

The Table 4 summarises the main hypotheses and their level of acceptance.

The first important outcome of this work is that environmental practices are key determinants in increasing a fashion company's innovation level. In fact, the implementation of environmental practices implies a change in the way of running business for fashion companies, thus differentiating from competitors in terms of outstanding product quality and process and product improvement. In this way, companies become more innovative and compete with more differentiating advantages in the market. For instance, as concerns SC oriented practices the introduction of environmental certifications in the entire supply chain help fashion companies not only to approach the sustainability issues in a systemic way, but also to achieve in less time a differentiation compared to other supply chains of the fashion industry that have not yet addressed the sustainability issue. In the same way, the introduction of ecological products, realised for example using organic raw materials and sustainable packaging, acts a distinctive differentiation in the market, in terms of quality, product and process, since always-new customers are interested in sustainable collections. Although this result is new in terms of the domain of application (the fashion industry has not been previously investigated so far), the insights are consistent with the existing literature, addressing the significant connection

between environmental sustainability and innovation performance (Haanaes et al. 2011; Wu and Pagell 2011; Zhu, Sarkis, and Lai 2012a, 2012b; Hallstedt, Thompson, and Lindahl 2013).

The second important outcome pertains to the confirmation that collaboration along the SC is a valuable factor in innovation. This outcome is consistent with the existing literature (e.g. Abecassis-Moedas 2006; Cappetta, Cillo, and Ponti 2006; Faisal 2010), which indicated the prime importance of collaboration in the achievement of higher innovation performance in the fashion industry. Collaboration with partners, both suppliers and retailers, as well as the establishment of long-term contracts with partners can foster the innovative capabilities of companies. In our opinion, this result is exploited by the characteristics of the Italian fashion industry. By and large, the Italian industry is composed of many small and medium-sized companies, whose suppliers are small or very small; and suppliers are often responsible for all production activities. This industry feature makes collaboration with external suppliers essential in order to guarantee an outstanding level of innovation. Although this result is consistent with previous literature about innovation and collaboration, in particular for aspects of NPD aspects (e.g. Petersen, Handfield, and Ragatz 2005), the area of application to the fashion industry, using quantitative analysis, is a new contribution from a literature perspective. We believe that this result is valuable for practitioners as well, by confirming the importance of collaboration in the supply chain for improving overall performance, not just in terms of efficiency but also for other strategic parameters such as innovation.

This work also highlights the fact that distribution in foreign countries has a flywheel effect on innovation when product environmental practices are adopted. This effect could be driven by the fact that different countries have different regulatory requirements and foreign companies are forced to follow environmental legislation in order to enter a new market. This encourages companies to innovate their products: companies not only adapt their products to foreign legislation, but also use these strict environmental requirements to innovate their production by offering an improved differentiation of products and processes to new conscious consumers. This phenomenon is seen not only in case of developed and mature markets, but also in the case of developing countries. For instance, in the Chinese market, protection for imports is increasing, requiring firms to provide environmental guarantees. This result is particularly relevant in the fashion industry where innovation drives demand, and companies always

strive to enhance it so as to retain consumers or gain new ones. Accessing international markets with environmental-friendly products might be a way to overtake other factors (such as the price) that sometimes could be even in contrast with fashion innovation. This result is new from a research perspective, given that the literature thus far has not revealed the important role of internationalisation in the achievement of positive innovation results through product environmental practices.

On the contrary, when dealing with the impact of SC environmental practices on innovation, distribution in foreign countries has a negative moderating effect. Indeed, when foreign distribution increases, the relationship with retailers loosens because companies sell primarily through independent stores in foreign countries. The adoption of ecological point of sale is more difficult because of the lower degree of control held by companies. Because internationalisation reduces the capability to 'be green' at the point of sale, improving innovation performance becomes more difficult. This result is consistent with the literature (Zhu, Sarkis, and Lai 2008; Faisal 2010; Nagurney and Yu 2012), which addressed the potential negative impact of distribution internationalisation in the improvement of innovation performance through sustainability. Indeed, managing global distributive SCs requires an increased attention to cope with environmental objectives (van Bommel 2011).

Similarly, our results show that production in foreign countries has a negative moderating effect on the impact that product environmental practices have on innovation performance. As suggested by Nagurney and Yu (2012), the implementation of product environmental practices when products are manufactured in foreign countries does not allow companies to enhance the virtuous innovative cycle as they could with close relationships. Our results show that this is also true when dealing specifically with the fashion industry. In fact the research and developments phases, necessary to design new green products and to identify new green raw materials, can hardly be carried out in depth if the production sites are located abroad. Many authors (e.g. Macchion et al. 2015) have shown in fact that the production of more innovative products is possible only with manufacturing facilities located near the company's headquarters. If we consider that in this industry companies launch two to six collections in one year (and the market tendency is increasing the number of always-new collections), this result seems to enhance the importance of fashion companies monitoring foreign suppliers (especially those in developing countries with different sustainability cultures and practices) for sustainability reasons.

A further result of this work is that production in foreign countries does not have any moderating effect on the positive impact that SC environmental practices have on innovation performance. Where the production takes place is not important if the company is able to properly control its factories, especially by developing green certifications to support this control. In this sense, the introduction of correct and solid sustainability practices in the supply chain is more important than the location of production sites in order to improve innovation performance. If a company extends adequate environmental certifications along the supply chain it will be able to ensure a good level of control and compliance with environmental requirements independent of where the manufacturing factory is located, and in this case the internationalisation of production does not affect the relationship with innovation performance.

6. Conclusions

Considering the importance that innovation plays in the fashion industry, this research contributes to deepening the debate on this topic by investigating the relationship between the adoption of practices (environmental SC, environmental product and collaboration practices) and the improvement of innovation performance in the Italian fashion industry. As a result of the debate on the role of internationalisation in the achievement of benefits through sustainability, the paper also verifies whether the internationalisation level, in terms of production and distribution activities, moderates the relationship between environmental practices and innovation performance. The research hypotheses were verified using a survey-based methodology applied to the Italian fashion industry.

The first relevant result of this study is that environmental sustainability practices have a positive and significant impact on the improvement of innovation performance. This result is aligned with existing studies addressing the key role of sustainability in innovation that, however, has not previously focused specifically on the fashion industry. This research contributes to this debate and is valuable for two reasons: it considers the fashion industry, a context in which innovation is very important, and the emerging results are also meaningful for practitioners because of the importance that innovation and also sustainability has today for fashion companies. Thanks to this work, practitioners are aware of an additional method of improving their innovation performance, as well as of an alternative lever for the implementation of sustainable programmes in their firms: within an industry ruled by innovation, finding new ways to improve this performance may be a critical asset for fashion companies.

Moreover, the research highlights the important role of collaboration in the achievement of innovation goals in the fashion industry. The development of competitive advantage (in terms of innovation performance) requires robust cooperation among fashion partners. In the fashion industry in particular, characterised by strong volatility of demand, rapid change of styles during seasons, and supply chain fragmentation, the implementation of long-term collaboration becomes a successful approach to reduce unpredictability. From this perspective, coordination among different actors in the supply network also becomes a prerequisite to compete in the fashion world from an innovation perspective. The focal company, which rules the SC, should involve supply chain partners in sustainability projects from the early phases of product and process development, defining each other's responsibilities and competences in regard to product and processes development.

Finally, an additional important result is the role of internationalisation in the achievement of innovation performance. Our results suggest that internationalisation has a moderating effect in the case of environmental practices. Thus, our work contributes to the debate about the controversial role of internationalisation in the achievement of benefits through sustainability that so far has never been investigated within fashion industry. In fact, an

interesting finding of this paper is that the two internationalisation strategies (i.e. production and distribution) have different moderating effects from an environmental product perspective. The internationalisation of distribution positively moderates the relationship among environmental product practices and innovation, but the internationalisation of production negatively moderates the same relationship. This evidence suggests that internationalizing the distribution markets for a company interested in sustainability can be a great opportunity to achieve new knowledge and differentiate products and processes in an innovative way; instead the internationalisation of manufacturing production is a real challenge for fashion companies that should be considered as if the aim of the company is developing more standardised products because in the case of international production the innovative profile of a company suffers heavy contractions. For what concerns SC environmental practices, the distribution internationalisation surely becomes a difficult task that can decrease the innovative profile achieved at national level because of the lower degree of control that a company can have on global contexts; at the production point of view the internationalisation has no effects on the positive impact that SC environmental practices have on innovation performance, because in this case the development of environmental practices for sustainability appears to be more important than the location of the production site. These results are also very relevant to practitioners because they combine three main challenges for fashion companies: sustainability and internationalisation in relation to innovation objectives.

The main limitation of this work is the survey scale; with future editions of the survey, we will aim to increase the sample size, perhaps through the introduction of additional countries to allow cross-country comparisons and develop a longitudinal analysis, which will increase knowledge over time of relatively new topics, such as sustainability, for the fashion industry.

On the other hand, this piece of research opens doors for further investigations by considering additional performance elements (such as cost or time); this would be helpful in investigating the existence of synergies as well as trade-offs among different performance indicators. Moreover, in this paper we considered innovation as a performance; whereas innovation can be considered as a driver as well for addressing whether companies with a strong driver towards innovation would also have a higher implementation of sustainability practices. The analysis conducted thus far only considers whether distribution and production activities are performed in foreign countries rather than in Italy: in future studies the ownership of distribution and production activities might be worth studying, because the implementation of sustainable practices in third party facilities might be harder than in directly owned stores or plants. Moreover, in this study we considered companies performing both clothing and accessories, although these categories are quite different in terms of processes; in further investigation of the paper, it might be interesting to address whether different results would be identified per these two product categories. Finally, further studies could extend results obtained in the fashion industry in other market contexts. In particular we suggest deepening our results in sectors similar to the fashion industry, characterised by high demand volatility, international supply networks and seasonal productions.

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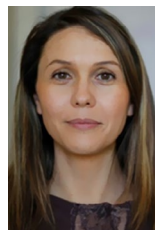
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Appendix 1. Items used in the analysis.

Area	Variable	Scale	Average
Environmental practices – supply chain practices	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
Environmental practices – product practices	Introduction of ecological products	Adoption (1 none – 5 high)	2.23
	Adoption of green raw materials	Adoption (1 none – 5 high)	1.85
	Adoption of green packaging	Adoption (1 none – 5 high)	2.99
Supply chain collaboration	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
Performance	Differentiation from competitors through outstanding product quality	(1 deteriorated – 5 improved)	3.40
	Differentiation from competitors through process improvement	(1 deteriorated – 5 improved)	2.99
	Differentiation from competitors through product improvement	(1 deteriorated – 5 improved)	3.71
Moderator	Share of production value in foreign countries	Percentage	43.09%
	Share of distribution (sales) in foreign countries	Percentage	24.68%