Journal of Cleaner Production 193 (2018) 169–184

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

# Designing a roadmap towards a sustainable supply chain: A focus on the fashion industry

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ARTICLE INFO

*Article history:*
Received 21 January 2017
Received in revised form
11 April 2018
Accepted 30 April 2018
Available online 7 May 2018

*Keywords:*
Sustainability
Supply chain
Roadmap
Fashion
Luxury
CSR

ABSTRACT

Fashion companies are extremely sensitive to the new challenge emerging from recent sustainability scandals. Existing literature has debated sustainability extensively by considering practices of sustainability that companies should apply. However, little research has focused on the design of a proper sustainability roadmap from a supply chain (SC) perspective to address the steps involved in implementing sustainability practices. The objective of this study is to design a sustainability roadmap for fashion companies. Based on case studies of three tiers of three fashion SCs as an empirical basis, social and environmental sustainability practices were grouped into a five-step roadmap. The main result of the paper is a five-step roadmap, characterised in terms of practices and main goal. The roadmap is then discussed in terms of possible paths of developing, in terms of evolution within a step and among different steps.



## 1. Introduction

In recent years, environmental and social sustainability has become a key managerial issue (e.g. Bocken et al., 2014). With their increased sensitivity to the sustainability challenge, companies have started working on the internal processes and products they deliver (Choi et al., 2012·Formentini and Taticchi, 2016). However, as managing environmental and social issues are not confined to the boundaries of focal companies, organisations must extend their focus to the supply chain (SC) network (Zhu et al., 2005; Krause et al., 2009). Firms must be held responsible not only for their own actions but also for those of their suppliers (Laari et al., 2017). Many companies have thus started to address the emerging issue related to the challenge of sustainable supply chain management (SSCM) (Seuring and Müller, 2008). The extension of these virtuous sustainability behaviours from focal companies through their supply networks represents one of the most complex business challenges at present because globalisation has created a fragmented scenario in which suppliers are dispersed across the world, and thus follow different environmental and social regulations (Sarkis, 2012).

Sustainability has become crucial to the SC's strategy, especially in sensitive sectors such as the fashion industry (Smith, 2003; Li et al., 2016). The recent worldwide environmental and social scandals of the fashion industry, accused of mistreating animals, applying unequal working and payment conditions to their employees, and creating eco-unfriendly collections based on heavy, polluting industry, have brought sustainability of the fashion sector into the public spotlight as an urgent issue that needs to be addressed (Turker and Altuntas, 2014; Winter and Lasch, 2016).

The fashion industry, with a turnover of €171 billion among 180,000 companies in the EU-28 area (EURATEX, 2017), has attracted the attention of several NGOs, which have started numerous initiatives (such as the well-known Detox Campaign by Greenpeace in 2011) to inform the public about the unpleasant aspects behind this industry. Many activities related to the production of fashion products are affected by critical environmental and social issues. Tanning activities, for example, have high environmental impacts in terms of water consumption (Masilamani et al., 2017); the cotton collecting for yarn production exploits local populations in plantations (Pedersen et al., 2016); and approximately 8000 synthetic chemicals are used to turn raw

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https://doi.org/10.1016/j.jclepro.2018.04.273
0959-6526/

materials into textiles, thus requiring stringent controls to safeguard the health of consumers and the environment (Karaosman et al., 2016). Therefore, fast-fashion giants (Turker and Altuntas, 2014; Shen, 2014) - such as H&M and Zara - have enlarged their sustainable collections, combining the style factor with the need for sustainable concepts. In the same way, luxury conglomerates such as LVMH and the Kering group, have undertaken and explored new routes toward sustainability (De Angelis et al., 2017).

Sustainability issues extended at the SC level are more than relevant to the fashion industry (De Brito et al., 2008), whose entire business model has been predominantly built on the use of fragmented suppliers – often located in low labour cost countries that lack stringent environmental and social regulations – and on highly polluting and consuming production processes (Lo et al., 2012). Although most contributions of existing literature focus on achieving sustainable practices in terms of either the social (e.g. Turker and Altuntas, 2014) or environmental aspects (e.g. Vachon and Klassen, 2006; Zhu et al., 2007; Nieminen et al., 2007; Choi et al., 2012; Yang et al., 2010; De Angelis et al., 2017; Laari et al., 2017), an in-depth study should examine both aspects to support the implementation of these practices over the coming years.

While existing SSCM literature presents sustainability roadmaps as a useful tool for implementing sustainability practices within companies, a complete sustainability roadmap for the entire SC is lacking, particularly with a focus on the fashion industry. A roadmap designed for a specific industry is therefore needed, which can be designed based on the practice-oriented approach of roadmapping (Bolboli and Reiche, 2013). The roadmapping approach involves identifying specific practices for the industry under investigation. However, to our knowledge, a sustainability roadmap that can direct managers in the introduction of SC sustainability programmes and explain the stages of developing sustainability at both the organisational and operational levels is lacking (Chofreh et al., 2015; Arena and Chiaroni, 2014).

To fill this gap in the literature, this paper aims to design a sustainability roadmap that considers both the environmental and social practices with a long-term perspective for fashion SCs. This goal uses an inductive approach to conduct case studies of three SCs, which include 18 companies. Social and environmental sustainability practices were grouped into a five-step roadmap and possible paths of developing and implementing the roadmap in practice are discussed.

## 2. Literature review

### 2.1. The roadmapping approach

The concept of roadmapping is a broad topic that has been applied to many business contexts using a variety of approaches (Phaal et al., 2004), and research and practice define roadmapping in different ways. For example, De Reuver et al. (2013) defined a roadmap as "*a detailed plan to guide progress toward a goal*"; whereas, Robert Galvin, former Motorola chairman, delineated a roadmap as "*an extended look at the future of a chosen field of inquiry composed from the collective knowledge and imagination of the brightest drivers of the change*" (Saritas and Aylen, 2010). Here, roadmaps are considered essential models for mobilising companies to assess different pathways and develop action plans to deliver strategic targets (Caritte et al., 2015).

A roadmap can be designed based on a goal-oriented method, which means that attempts are made to achieve a desired future state of development. By offering a look into the future, roadmaps allow a clear understanding of the actions and decisions to be made (Phaal et al., 2004; Bolboli and Reiche, 2013), ensure the setting of clear objectives, define an action plan for achieving these objectives, and thus help managers to prioritise their companies' next steps (Saritas and Aylen, 2010), analyse critical decision points and monitor progress (Saritas and Aylen, 2010; Ahmed and Sundaram, 2012). As such, roadmaps should take into consideration the main reasons for the planned change and incorporate clearly defined timelines and the intermediate phases (Saritas and Aylen, 2010).

### 2.2. Roadmaps and sustainability

Existing literature presents and discusses many different kinds of roadmapping (Phaal et al., 2004), but the practice-oriented roadmap is useful for implementing new processes that improve business models (Bolboli and Reiche, 2013). This practice-oriented roadmap is particularly suitable in the case a sustainable change to design a proper sustainable path within companies by identifying practices and steps to transform organisations accordingly to a sustainable transformation (e.g. Paramanathan et al., 2004; Rivero and Daim, 2017). According to Cavalcanti Sá de Abreu (2015), "a *company has to address priorities among the various possibilities in achieving sustainability goals and develop an implementation plan with the most appropriate allocation of resource over time. A well-developed and detailed roadmap could therefore enable organisations to develop a plan in such uncertain and evolving topic often approached unsystematically*". Sustainability programmes are strongly affected by uncertainty, and most previous studies on sustainability have highlighted that the outcomes of sustainable programmes change over time (e.g. Lin and Tseng, 2016). According to Ahmed and Sundaram (2012), although many organisations are committed to transforming their business by undertaking sustainable initiatives, they have failed to achieve the goal because they have follow traditional methods of business management, supporting only some pillars of Triple Bottom Line dimensions (i.e. environmental, social and economic) and making only task-oriented decisions. In fact, managers facing the sustainability challenge often establish a series of initiatives without first developing an overarching vision or plan that can be supported by a clear trajectory over several years (Lubin and Esty, 2010). A roadmap can thus be considered a way of guiding the decision-making process involved in developing companies' sustainability programmes (Ahmed and Sundaram, 2012), and for future sustainability improvements (Could and Wallbank, 2007).

Although it is clear that the design of a roadmap towards sustainability can foster the alignment between organisational and operative practices within companies (Ahmed and Sundaram, 2012; Ageron et al., 2012; Srivastava, 2007), existing literature rarely addresses the problem of designing sustainability roadmaps from an SC perspective (Silvestre, 2015). For instance, Paramanathan et al. (2004) were among the first authors to highlight the possibilities of using a plan, although not a clear roadmap, for sustainability objectives; however, they focused on the technology planning perspective of a single company. Additionally, Robinson et al. (2006) presented a roadmap to implement a knowledge management system to achieve sustainability goals in companies. Other contributions focused on specific areas of company management. For example, Vanegas (2003) proposed a roadmap to build environmental sustainability in human resources and procurement, Waage (2007) focused on integrating sustainability in product design, and Bolboli and Reiche (2013) designed a sustainability roadmap for the quality area. In addition, while Rocco

(2015) offered an environmental roadmap for the design phase, Chofreh et al. (2015) focused on roadmap identification for a sustainability objective for project management activities. Only Nidumolu et al. (2009) and Valkokari et al. (2014) provided a path to sustainability that considered aspects related to both a single company and SC issues.

### 2.3. Research question

An examination of existing literature reveals that, even if it recognises the value of practice-oriented roadmaps in facilitating a sustainable change (Bolboli and Reiche, 2013), they typically focus on the environmental aspects of sustainability, which is insufficient when considering the complexity of achieving full sustainability profiles composed of advanced environmental and social sustainability practices. A complete sustainability roadmap should cover both aspects of sustainability.

In addition, the existing literature fails to include a SC perspective (De Reuver et al., 2013; Silvestre, 2015). Brandenburg et al. (2014) supported that sustainability studies should adopt a broad perspective and attempt to include actors along the SC instead of limiting the analysis to a firm or dyadic level firm-supplier. However, previous roadmaps designed for sustainability objectives only considered the boundaries of a single company (e.g. Paramanathan et al., 2004; Robinson et al., 2006; Waage, 2007; Bolboli and Reiche, 2013; Rocco, 2015; Chofreh et al., 2015).

Finally, despite recommendations to include the dimension of time to properly support a sustainable business revolution (e.g. De Reuver et al., 2013; Valkokari et al., 2014), few structured roadmaps consider the sequential evolution of sustainability practices to drive a sustainable path over several years (e.g. Lin and Tseng, 2016), particularly in rapidly changing environments such as the fashion industry (Cavalcanti Sá de Abreu, 2015).

Overall, to fill the gaps in the existing literature, the present study aims to design a roadmap with a long-term perspective that can direct management in the fashion industry to develop a sustainable SC based on environmental and social sustainability. The study therefore aims to answer the following research question:

RQ: How can fashion companies design a sustainability roadmap, consisting of sets of practices to be adopted along the supply chain in the long term?

## 3. Methods

### 3.1. Sample selection

This study applied an inductive methodology (Gioia et al., 2013) that allows the development of a new theory based on case study evidence. Companies were selected for study based on the presence of a focal company (ruling the sustainability strategy of the entire SC) that was oriented towards sustainability in their mission and to include a selection of companies representing the main product categories of the fashion SC, namely leather, wool and silk goods. The companies were sought by examining secondary data (e.g. websites, sustainability reports and GRI rankings) to identify relevant sustainability cases in the fashion sector.

Three companies were chosen based on Eisenhard's (1989). To design a sustainability roadmap with a SC orientation, the cases are developed at the SC level and involve actors at three different levels (i.e. the focal company, first-tier suppliers and second-tier suppliers).

1. SC-A is a leather SC involving the focal company, the main first-tier supplier and nine second-tier suppliers that produce mainly bags and accessorises.
2. SC-B is a silk SC involving the focal company, the main first-tier supplier and two main second-tier suppliers for the production of mainly neckwear.
3. SC-C is a wool SC involving the focal company, the first-tier supplier responsible for the entire production and two main second-tier suppliers that produce knitwear.

Overall, 18 companies were involved in our study, with the goal of considering the main companies responsible for production activities of each stage.

### 3.2. Data collection

Data were collected through direct interviews conducted during company visits to each plant in 2016. The interviews used a semi-structured interview protocol, and respondents were asked to narrate their companies' journeys towards sustainability, particularly addressing the following:

- the approach towards sustainability;
- the sustainable practices implemented in their company, including a discussion on the sustainability practices identified by the literature for the fashion industry (Table 1);
- the year sustainable practices were implemented; and
- the main driver for the implementation, with a main focus on the role of the brand owner in the implementation of sustainability.

The cases were examined using a retrospective approach: each company was asked to describe their path towards sustainability, detailing the activities performed since 2006. The managers of all 18 companies involved in the research were already employed by the company in 2006; in that way, they provided their direct description of the phenomena. Data related to the future were also gathered. Therefore, data were collected for the period 2006–2018. The earliest year (2006) was selected because the focal companies' first sustainable practices were implemented around that year, and the latest year (2018) was selected because the companies were asked to describe their upcoming projects within the SC and this timeframe is consistent with the budget planning. This time range is considered sufficient for designing a time-based sustainability roadmap (e.g. Cavalcanti Sá de Abreu, 2015; Valkokari et al., 2014).

At least 3 informants were interviewed at each company; thus, among each SC, around 20 interviews were conducted with SC, purchasing and sustainability managers. Focal company participants were selected i) through direct contact with the managers of the selected company or ii) new contacts were made by phone or email. To organise the interviews with the suppliers, the focal company contacted suitable suppliers. To avoid information bias, the interviews with the suppliers were conducted separately from the interviews with the focal company. Each interview was recorded when possible and attended by at least three researchers: two researchers among the authors of the paper and one independent researcher. Most of the interviews lasted more than 120 min.

Beyond the direct interviews, the data were triangulated with additional data (i.e. internal reports of each company) to improve the accuracy of the roadmap by combining different sources of information (Gibbert et al., 2008; Saritas and Aylen, 2010). Secondary data were obtained from company presentations, financial

**Table 1**
Description of SC-A, 2015 – SC -A includes 1 focal company, 1 first-tier supplier and 9 s tier suppliers.

| Company | Position in the chain | Turnover 2015 (mln €) |
|---|---|---|
| Focal Company A (FCA) | Focal company (brand owner) | 1000–2000 |
| Producer A (BPA) | First-tier supplier | 25–50 |
| Tannery-1A (T1A) | Second-tier supplier (leather) | 10–25 |
| Tannery-2A (T2A) | Second-tier supplier (leather) | 25–50 |
| Tannery-3A (T3A) | Second-tier supplier (leather) | 10–25 |
| Tannery-4A (T4A) | Second-tier supplier (leather) | 10–25 |
| Tannery-5A (T5A) | Second-tier supplier (leather) | 50–100 |
| Tannery-6A (T6A) | Second-tier supplier (leather) | 10–25 |
| Tannery-7A (T7A) | Second-tier supplier (leather) | 10–25 |
| Tannery-8A (T8A) | Second-tier supplier (leather) | 50–100 |
| Tannery-9A (T9A) | Second-tier supplier (leather) | 10–25 |

and sustainability reports, previous case studies and direct observations during the interviews. Financial data available in the reports were also checked with AIDA data.

### 3.3. Coding of the interviews

To answer the research question, this study used a practice-oriented roadmap approach (e.g. Paramanathan et al., 2004), and because no sustainability roadmaps have previously been developed in the literature for the fashion industry, this study used literature concerning SSCM for fashion companies to identify the main sustainability practices currently implemented in the fashion industry. This study also investigated practices at the operational and organisational level because the literature review underlined that sustainability roadmaps can foster an alignment between these two aspects within companies (Srivastava, 2007; Ahmed and Sundaram, 2012; Ageron et al., 2012). Based on González-Benito and González-Benito (2006) definition, two types of practices were used:

- *Organisational practices* reflect the extent to which a company and its SC explicitly define a sustainability policy and develop clear objectives and a long-term plan for establishing sustainability objectives, selecting and implementing sustainability practices, and assessing the outcomes of such practices. These practices also define sustainability responsibilities implemented by full-time employees devoted to sustainability management and improvement.
- *Operational practices* include all the practices that focus on developing and implementing of more sustainable processes in both the supply and production of conscious collections.

Appendix A summarises the main sustainability practices coded for the fashion industry.

### 3.4. Data analysis

Interviews were recorded and collected data were reported and organised based on the main areas of the interview protocol; in this step, data collected through direct interviews were combined with the secondary data. In case that some data were missing or unclear, respondents were contacted again by phone for clarification. The data analysis involved four stages: a within-case analysis, a cross-case analysis at the company level, a cross-case analysis at the SC level and a theory building stage. To maintain the narrative of the findings, in the within-case analysis, several quotations of informants were retained. For data reduction in the cross-case analysis, the companies were compared based on sustainability practices (Appendix B) and companies at the same SC level were considered (Appendix C for suppliers and Appendix D for the focal company) based on a time perspective, representing the chronological order of practices implementation. Finally, the theory building stage involved iterating data and theory and designing the roadmap (Fig. 1).

Four researchers were involved in the data analysis process to triangulate information and increase the descriptive validity.

### 3.5. Within-case analysis

#### 3.5.1. Supply chain A – leather good companies

SC-A (Table 1) is driven by a focal company leader of leather goods. The company, which operates in the luxury goods industry producing mainly women's bags and accessories, had a turnover of about €1.8 billion in 2015. The company is part of a French group, but the headquarters and main facilities are located in Italy. As the focal company has been implementing sustainable practices for several years, it has already implemented sustainable practices at the company and SC levels. Sustainability is managed through a sustainability department at the country level, aligned with the one at the group level: these departments aim to help not only the company but also the SC partners in transforming their business to one that is more sustainable. Sustainability is a priority for the management as summarised in their mission: *"A smart business is a sustainable business"* and *"Sustainability is already inside the quality of our product"*. Initially, investments were devoted to understanding the sustainability concept from an organisational and operational perspective. Subsequently, the beginning of the certification process promoted an increased awareness about their as-is sustainability level. Owing to the definition of medium-term sustainability objectives, the company focused initially on the selection of sustainable raw materials and more recently on the redefinition of internal and external processes with a sustainability perspective.

The first-tier supplier A is directly controlled by the focal company (formally, it is a joint venture) and is responsible for the production of the finished products. The supplier is in charge of production activities, but raw materials are bought by the focal company directly from tanneries. Driven by the focal company, this supplier undertook a sustainability path: internal audits and analyses created an awareness about the processes and procedures to follow during the initial stages of the sustainable change. Their early initiatives focused mainly on energy-saving solutions; however, their future attention will be on improving their buildings and machineries.

Nine different tanneries located in Italy were contacted for this study, representing around 80% of the raw materials bought by the focal company. The nine tanneries are quite similar in terms of their sustainability practices. They each have well-defined processes and

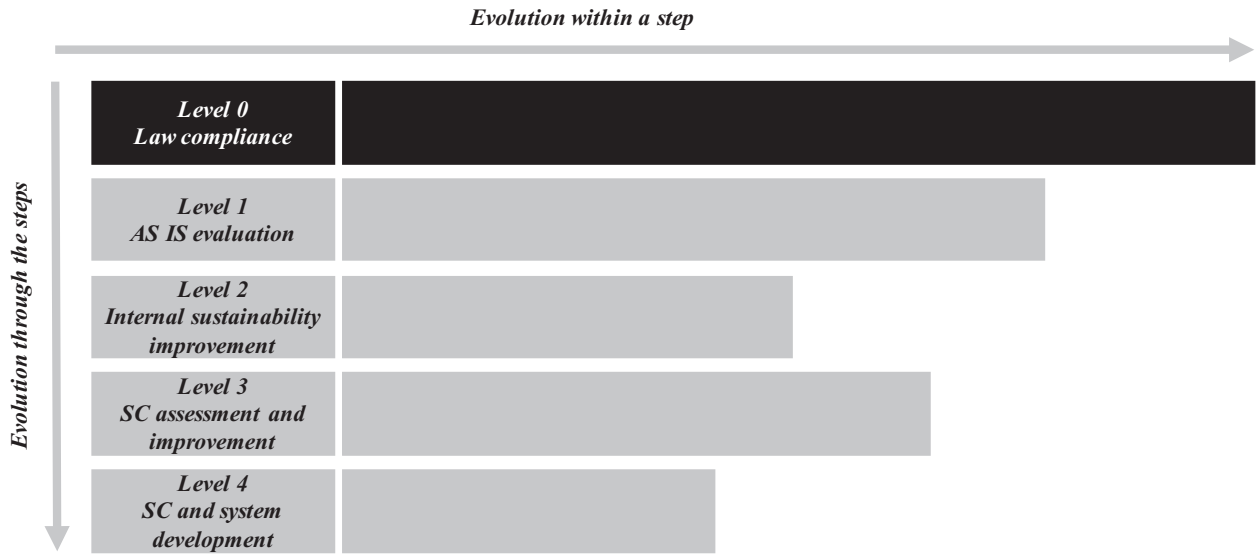


**Fig. 1.** The evolutionary process of implementing the sustainability roadmap follows two main directions: evolution within a single step (making broader the extension of use of a practice) or through the steps (increasing the number of practices implemented into a small part of the company such a single plant, a single product, a single business unit).

**Table 2**
Description of SC-B, 2015 - SC -B includes 1 focal company, 1 first-tier supplier and 2 s tier suppliers.

| Company | Position in the chain | Turnover 2015 (mln €) |
|---|---|---|
| Focal Company B (FCB) | Focal Company (brand owner) | 1000–2000 |
| Neck Tie Producer-B (NTPB) | First-tier supplier | 1–5 |
| Silk Factory-1B (SF1B) | Second-tier supplier | 50–100 |
| Silk Factory-2B (SF2B) | Second-tier supplier | 50–100 |

procedures, and they have invested in resources for waste management and implemented solutions to reduce energy consumption. Because the leather production process consumes considerable quantities of water, their current focus is to reduce their water consumption in the production processes and machineries and develop partnerships with chemical manufacturers to reduce water pollution. In the future, the tanneries are planning to invest in the research and development of new metal-free technologies that will change the production of the entire industrial system.

*3.5.2. Supply chain B – neckwear companies*

The focal company B of SC-B (Table 2) is a German company, which has almost 14,000 employees and a turnover of €1.250 million (2015). The company, which produces clothing, shoes and accessories for men, has production facilities in Turkey, Poland and Italy. The company mission indicates their recognition of sustainability as a strategic priority: *"an opportunity to guarantee the high quality of products expected by the customer, ensure customers' loyalty, drive forward innovations and further develop the business model, increase efficiency along the value chain and increase the loyalty of its own employees over the long-term"*. In 2013, the company established a Sustainability Committee to define its sustainability strategies and targets. The company is included in the Dow Jones Sustainability Index, and its sustainability ratings are linked with the managers' compensation.

The first-tier supplier is a small company with a 30-year history producing neckties. The company turned over €1,15 million in 2015, and while it only has 15 employees, it relies on a well-developed network of home workers and small local laboratories for specific production phases. The company is completely dedicated to focal company B's production, producing 2400–2700 pieces a day, which cover about 45% of the focal company's needs. Its key success factors, as well as craftsmanship and workforce experience, are its short SC with an extraordinary level of flexibility to face seasonal variability. Being a strategic supplier, the company is regularly audited by the focal company and subjected to strict requirements in terms of sustainability documentation, certification and assessment. Moreover, the company has to monitor their sub-suppliers based on the focal company's code of conduct. Second-tier suppliers and external laboratories are traced by the focal company to assure the highest level of transparency along the chain. However, this kind of assessment is not exerted on fabrics' suppliers (i.e. the second tier suppliers in the SC chosen for the analysis) because the company does not have a direct relationship with them. In this case, sustainable initiatives are mainly driven by the focal company's requests. However, the focal company also adopts a "mentoring approach" to help small companies fulfil their high-demanding requirements.

In terms of second-tier suppliers, the two selected suppliers are worldwide leaders for the production of silk, both founded in Como in the first half of 1900. The companies have similar business models because they control the entire production process, from the initial creative phase to product completion. Silk Factory 1B developed a management system that integrates quality, environment, safety and social responsibility into one system because, for them, "*Quality means ongoing improvement of business processes and internal and external customer satisfaction. Environment means sustainability and therefore respect for the ecosystem, less consumption, more attention to materials and products, recycling. Safety regards people at work, process and environmental safety and Corporate Social Responsibility is their commitment toward people, community and*

**Table 3**
Description of SC-C, 2015 - SC -C includes 1 focal company, 1 first-tier supplier and 2 s tier suppliers.

| Company | Position in the chain | Turnover 2015 (mln €) |
|---|---|---|
| Focal Company B (FCB) | Focal Company (brand owner) | 1000–2000 |
| Knitwear Producer-C (KPC) | First-tier supplier | 25–50 |
| Weaving Factory-1C (WF1C) | Second-tier supplier (leather) | 100–150 |
| Weaving Factory-2C (WF2C) | Second-tier supplier (leather) | 50–100 |

*society*". The top management of the Silk Factory 2B stated, "*sustainability is among a company's priorities being as it an increasingly important issue among the components of the production chain of garments. For us it is an urgent matter because we believe in this concept as a company and the market asks for it. Despite being a burden, both in terms of organisation and economic effort, we believe that sustainable production is a business opportunity: companies that in five years will not have been able to reduce their environmental impact will not exist anymore. A team of three people has been created to perform analysis on chemicals, with the aim of understanding which of these could be replaced in the future*".

#### 3.5.3. Supply chain C – knitwear companies

SC-B and SC-C produce two very different products (with totally independent SCs) but have the same focal company in common. Thus, the focal company for SC-C (Table 3) presents the same holistic approach to sustainability as that described for SC-B.

However, producer SC-C is a small organisation established in Ancona (Italy) in 1981, producing high quality knitwear for well-known international brands. The company takes care of the entire production of knitting with a strong attitude towards innovation, which is also reflected in sustainable production to anticipate the customers' expectations and legal requirements. The main drivers for the implementation of sustainable practices within the company are customer requests, law compliance, internal ethics and ownership commitment as well as the willingness to establish and nourish a good relationship with employees.

Weaving Factory 1C is a spinning mill founded in 1958 and based in Cagli (Pesaro-Urbino, Italy) that operates in 28 countries, mainly in the US and Japan. The company has 263 employees and, in 2015, it recorded a turnover of €102.7 million. The company pays attention to new business opportunities, which is also reflected in its deep commitment to sustainability and many other initiatives they have in place. The company achieved all the main certifications (ISO 140001; Oeko-Tex certification; OHSAS 180001) many years ago, and it recently adhered to the Detox Greenpeace campaign through its collaboration with Weaving Factory 2C – a world leader in the high-end silk weaving and fabrics from natural fibres, which started in February 2015.

Weaving Factory 2C was established in Como in 1966. Founded as a silk manufacturer, today it is world leader in the high-end market producing not only silk but also textiles made from natural fibres such as cashmere, wool, cotton, linen and hemp. The company is present in the global market and has commercial relationships with major international brands for which it manages distribution licenses. With around 495 employees, the company recorded in 2015 a turnover of €87 million. New materials, special designs and new collections characterise their vision. Because of its continual search for innovation, the company has grown significantly. Several ecological and industrial patents confirm their position as a fast mover on the market. The company demonstrates high interest and responsibility while approaching the topic of sustainable development: "*In our company, sustainability is considered both as a source of competitive advantage (since 2008, when the world economy began to slow down, we adopted a pioneering approach putting sustainability goals at the center of our business) and as an ethical commitment vital in one of the most impacting industry of the world*". The sustainability journey, which started around 10 years ago when the market was still immature in terms of sustainability initiatives, has been driven by the management's strong commitment. In 2012, it was the first textile company in the world to endorse the Greenpeace Detox Campaign, and it has achieved important sustainability-related certifications (Certification ISO 140001, ISO 50001).

## 4. Results and discussion

### 4.1. Identification of the roadmap

The roadmap was designed through a cross-case analysis to identify the implemented practices (Appendix B). The analysis of the results allowed some preliminary considerations. Almost all the practices implemented in the roadmap were mentioned by at least one company, to ensure that the selection of practices reported in Appendix A is representative of the industry under investigation. However, not all the companies were at the same level of in terms of their sustainability: the two focal companies have introduced a much higher number of practices compared to the first- and second-tier suppliers.

To design the roadmap (Table 4), the focal companies were compared to understand the evolution of their sustainability journey (Appendix D).

The starting point for each company is level zero: *Law Compliance* because companies need to comply with laws at the national level, and also at the international level in the case they work internationally. Law compliance means that companies should adhere to the limits related to emissions and the use of chemical and hazardous materials in raw materials and final products, and meet waste management requirements. The laws also provide regulations related to health and safety in the workplace and environmental protection, prevent child and forced labour and all forms of discrimination, and respect the freedom of association and the right to collective bargaining. These laws are extended to the suppliers. As the starting point for a journey towards sustainability, law compliance is an important driver for sustainable development (Srivastava, 2007; Zhu et al., 2007).

The first level of the roadmap concerns the *AS IS evaluation*, which aims to (1) understand what sustainability means for the company; (2) verify the potential of sustainability in terms of benefits, costs and efforts; and (3) promote awareness about sustainability at the top management level. Companies perform a sustainability assessment of their water, energy and waste levels, and they assess the employees' sustainability competences by mapping their production processes. For their operational practices, companies develop tests to verify the mechanical and chemical characteristics of their final products. Additionally, many companies implement voluntary standards or a certification course to improve their sustainability profile and knowledge. Adhesion to universally recognised standards of sustainability (e.g. ILO, UN Global Compact, OEDC Guidelines for Multinational Enterprises and

**Table 4**
The roadmap is composed by five steps, each of those characterised by some specific sustainable operational and organisational practices and with indication of the main goal.

| | Practices | | Main objective |
|---|---|---|---|
| | Operational practices | Goal | Goal |
| 0. Law compliance | • Respect of **limit related to chemical and hazardous materials** in final products and raw materials, emission, waste management | • Respect of law regarding health and safety at work | **Law compliance** for national/ international selling |
| 1. AS-IS evaluation | • **Mapping** of processes to evaluate their consumption<br>• Adopt universally recognised **standard** (LCA at the internal level; ILO; UNGC)<br>• **Certification** (beginning process)<br>• Mechanical and/or chemical **analysis on final product** | • Regular **meeting** on sustainability<br>• **Philanthropic** initiatives<br>• Employee **training** on health and safety at work<br>• Definition of **sustainability goals** (formal and written policy; code of conducts) | **Understanding** what is sustainability<br>**Assessing** sustainability potential (in terms of benefits, cost, efforts)<br>**Promoting awareness** about sustainability among managers |
| 2. Internal sustainability improvement | • Sustainable **materials** (e.g. Eco-friendly packaging)<br>• Internal improvement of **logistics**<br>• Internal traceability<br>• Introduction of **green-building** solutions<br>• Energy and natural resources **efficiency program**<br>• **Avoiding** high-impact operations | • Economic **incentives** for managers and employees related to sustainability objectives<br>• Employee **training** on environmental sustainability<br>• Definition of a **CSR structure**, sustainability committee, Chief Sustainability Officer<br>• Internal **reporting**<br>• Micro-**budgets** for sustainability internal projects<br>• **Projects** with external actors (e.g. consultants, researcher)<br>• Benefit and organisational **welfare** | **Internal performance** improvements<br>**Promoting awareness** about sustainability among all the organisation |
| 3. SC assessment and improvement | • Purchase of sustainable materials<br>• Supplier **selection**<br>• Supplier **monitoring**<br>• **LCA** at SC level | • External communication | **Evaluation** of sustainability practices implementation at SC level |
| 4. SC and system development | • Supplier collaboration<br>• **Redesign** of network<br>• External traceability | • Advanced sustainability **reporting**<br>• **Knowledge sharing** with suppliers and actors of the SC | **Development of new** technologies/processes/materials at SC level |

Global Reporting Initiatives-GRI) or specific standards for the fashion industry (e.g. Detox Greenpeace Campaigns, Zero Discharge of Hazardous Chemicals [ZDHC] and REACH regulation) and the adoption of sustainability certifications (e.g. ISO 14001, ISO 26000, ISO 50001, SA 8000 and OEKO-TEX Standard 100) belonging to that phase of practices. In terms of organisational practices, companies establish a formal code of conduct, hold regular meetings to define their sustainability goals and start training employees about health and safety. This stage involves developing some philanthropic actions to support, for instance, the local communities and is consistent with previous literature on roadmaps, which state that if the final goal is to define the directions for the future, it is first necessary to assess the performance level in the present (De Reuver et al., 2013).

The second level is *Internal sustainability improvement*, which involves practices that enhance sustainable behaviour. The goals of this stage are threefold: (1) understanding what sustainability means for the company, (2) improving the performance achieved mainly in terms of costs and (3) increasing employees' awareness of sustainability awareness among all levels of the company. In terms of operational practices, this step includes implementing eco-friendly processes such as avoiding high-impact operations, introducing energy and natural resources efficiency programmes, using adhesives or water-based solvents, using low-impact dyes and eliminating sandblasting for denim because of its extreme danger to workers' health. Concepts such as green-building (i.e. sustainable materials and systems for lighting, heating, insulation, cooling and ventilation), waste management (i.e. reuse, recycle and proper waste disposal), sustainable packaging (i.e. recycled and reusable materials for packaging and shopping bags) and optimising load at the logistic level are also implemented at this stage. This stage also includes improvements in the social field that involve developing measures for supporting employees' families (e.g. a kindergarten service) or improving employees' satisfaction and working conditions (e.g. reducing machinery noise). Regarding the organisational practices, in this stage, companies introduce benefits for managers and employees to align the entire organisation with the sustainability goals, develop new training programmes to improve the employees' sustainability competences and develop organisational structures oriented to sustainability. These structures, based on dedicated budgets, are managed by either a Corporate Social Responsibility structure, Chief Sustainability Officers or sustainability committees who work with external experts to enhance the overall knowledge within the company. This finding, which aligns with existing literature on fashion sustainability at the company level (e.g. De Brito et al., 2008), shows that a combination of social and environmental practices are conducted to make the single company as sustainable as possible.

The third level of the roadmap is labelled *Supply Chain Assessment and Improvement.* This phase extends the focus on sustainability to the SC. Examples of practices concern the selection and monitoring of suppliers based on the sustainability criteria; considering the purchasing of certified materials, including social and environmental performance indexes or sustainable certifications; and selecting suppliers geographically close to minimise transport emissions. Other practices implemented at the company level are extended to the whole SC include the Life Cycle Assessment (LCA), the assessment of suppliers' sustainability performance specified in the contracts, the development or extension of the code of conducts to suppliers, the suppliers' self-assessment questionnaires or written statement stating how they address environmental and social issues, and the suppliers' audits about sustainability performance with the establishment of sanctions in case of failure to meet established criteria. Sustainable means of

transport are also selected through intermodal transports, low impact vehicles or alternative fuels and the monitoring of freight forwarders and logistic operators. In this vein, every shipment should be optimised for load and consolidation, route planning, and night-time and flexible schedule deliveries. At this stage, sustainability SC practice implemented are numerous and very relevant. Companies start presenting their sustainability effort externally through dedicated reports, and existing literature highlights the importance of moving beyond company boundaries to involve SC partners in the sustainability. This finding is therefore consistent with previous literature (e.g. Paramanathan et al., 2004; Robinson et al., 2006; Waage, 2007; Bolboli and Reiche, 2013; Rocco, 2015; Chofreh et al., 2015), and highlights that implementing complete sustainability SC practices is possible in the fourth stage of the process.

The last stage is the *Supply Chain and System Development*. New technologies, processes and materials at the SC level are developed explicitly for the purpose of sustainability. In this stage, the collaboration among different actors of the SC becomes essential for the complete fulfilment of sustainability (e.g. Vachon and Klassen, 2006, Seuring and Müller, 2008, Klassen and Vereecke, 2012; Sarkis and Dhavale, 2015). However, suppliers might not be able to introduce these changes by themselves because of a lack of knowledge in the sustainability field or the huge investments required for new sustainability improvements. Examples of practices in this stage include developing plans for educating SC partners and making suppliers aware of the sustainability issues along the SC. These plans are achieved through conducting workshops, creating written materials to dissemination among the companies and advanced sustainability reporting. New collaborations (such as with competitors or NGOs) can be setup to define common environmental and social standards. Considering the global dimension of the fashion SC, these sustainability collaborations become a challenging ambition that highlights the necessity to carefully reconsider the network design (Choi, 2016). A strong redesign of the logistics network might lead to the relocation of production and distribution sites near to markets, the construction of new SC nodes entirely designed in accordance with green building principles and the establishment of strict standards to accomplish full SC traceability.

### 4.2. Evolution of the roadmap

The roadmap illustrated in Table 4 is not a static model, but rather evolves over time for the company. To investigate the evolution, a cross-case analysis was performed with a time-spectrum analysis at the focal company (Appendix D) and supplier (Appendix C) levels.

The main evidence of this cross-case analysis is that companies, even those that are part of the same SC, are at different levels of the roadmap. As all of the companies under evaluation are fully compliant with existing regulations related to environmental protection and working conditions, this confirms that the “law compliance” step is the starting point of every path towards sustainability. Nevertheless, the levels of sustainability implementation are highly different among the companies. The two focal companies that have implemented practices up to the last step are the leading actors of the chain and they therefore need to share their approaches with the other levels of the chain by collaborating with first- and second-tier suppliers. However, these suppliers are at different stages. For example, the neckwear producer, a very small company, is considered to be at level two because the improvement of internal performance is the current main focus of the company. The company has not yet adopted sustainability standards or certifications, which might be because of their small dimension and lack of management commitment. By contrast, silk factory-1B and weaving factory-1C have reached level three because they have begun to push their approaches beyond the company boundaries. Additionally, while the tanneries are in step two because of their small size and economic availability to invest in sustainability projects, they have implemented some initiatives typical of step three (e.g. new processes and technological development with suppliers and actors of the SC) through encouragement from the focal company.

A defined order of steps is suggested to adopt complete sustainability. First, national and international regulations form the starting point for a sustainable change of fashion SCs. This is consistent with existing literature reporting that law compliance is essential for implementing sustainability at both the company and SC levels (e.g. Beamon, 1999). As Fig. 1 shows, each company has to be fully compliant with the existing regulations before moving forward. Therefore, each fashion company has to operate within its boundaries to identify their as-is state of sustainability and to implement new sustainability practices. Sustainability practices started at the manufacturing process level but then are extended: for instance, some interventions that are necessary in manufacturing processes are also necessary in buildings development (e.g. green building) and in the management of waste and natural resources. Social practices should be carried out alongside the environmental actions, and to incorporate green practices, companies should start their sustainable journey by considering the environmental issues at the plant level. This joint implementation of social and environmental practices supports the relevance of a triple bottom line approach (Elkington, 1997). Only after the company has addressed these issues can the sustainability principles be extended to the entire SC. This view is consistent with previous literature (e.g. Valkokari et al., 2014), because focusing solely on internal processes limits the possible achievements of sustainability.

However, a company' sustainability path is not always perfectly linear because overlap occurs between stages and companies could make steps back in the roadmap before moving forward. For instance, although the actions related to law compliance are at the root of the roadmap, companies must keep updated with new and future regulations to ensure constant compliance. This is consistent with the definition of a roadmap provided by Cavalcanti Sá de Abreu (2015) and suggestions of Lin and Tseng (2016) about the use of a roadmap into an uncertain context such as the fashion industry. An analysis of the three SC cases shows that the companies that developed their sustainability practices sometimes shifted from one step to another (referred to in Fig. 1 as evolution through the steps) and sometimes increased the level by adopting specific practices from one specific step of the roadmap (referred to in Fig. 1 as evolution within a step). For instance, in the case of a pilot sustainability project, such as the launch of a sustainable collection, the company first moved along all or most of the different steps of the roadmap by introducing practices at the company and SC levels, and after verifying the pilot test results, the company extended the area of implementation of those practices in the company and along the SC. However, some companies might start introducing a small number of practices of a single step and decide not to move forward through the steps until the current practices have achieved a desired level of completeness.

In the sustainability roadmap for the three SCs studied in this research, each step is represented by a progression line indicating the different levels achievable among the steps; thus, companies

with different sustainability projects will likely make different efforts in each step (Fig. 1). Except for step 0, "Law compliance", the steps can be implemented partially (as shown by the partial length of the blocks) depending on the level of sustainability practices adopted in each phase and according to the company's strategy. Fig. 1 represents a company that has fully implemented level 0, has achieved a significant implementation of levels 1 and 3, and initiated implementations for levels 2 and 4. In accordance with the latest research, the time dimension denotes how sustainability is an evolving and dynamic issue that should be studied using long-term methodologies (e.g. Lubin and Esty, 2010; De Reuver et al., 2013; Cavalcanti Sá de Abreu, 2015; Valkokari et al., 2014; Lin and Tseng, 2016).

The time-perspective of a roadmap is a result that provides important finding for both research and business. Moreover, the cases confirm the importance of implementing both the environmental and social aspects to promote a path of sustainable change: this is consistent with the triple bottom line perspective of existing literature (Elkington, 1997) and is a literature improvement from an academic viewpoint because most previous research focuses on either environmental (e.g. Zhu et al., 2007, Yang et al., 2010; Laari et al., 2017) or social sustainability (e.g. Turker and Altuntas, 2014). This is a key message for companies that are mainly used to considering the two pillars of sustainability separately, sometimes missing the holistic view about sustainability. At the same time, the roadmap shows that such actions can reinforce each other synergistically. Through their implementation, the company has the ability to develop new knowledge in the management of sustainable projects that are complex and inevitably dynamic, given the nature in the continuous evolution of sustainability. Only after introducing the internal changes can companies look beyond their boundaries and expand their vision to the entire SC. The findings herein reinforce those of existing literature that address the importance of looking beyond companies' boundaries to pursue sustainability (e.g. Rocco, 2015; Chofreh et al., 2015). The focus beyond company perspective is a relevant issue for managers, who often have a clear focus on internal choices and practices but fail to extend their focus to the upstream SC. In the fashion industry, several managers take a monitoring approach towards the suppliers and simply measure their performance; however, this research shows the importance of a development-oriented approach to go beyond basic sustainability practices.

Finally, the findings of the case studies suggest the importance of not only implementing operative practices but also of developing an organised organisational structure. Undertaking sustainability paths implies revising the governance management system to ensure that the organisational structure is consistent with the new business approach. Notably, to activate the roadmap, it is essential to implement the sustainability goals into the company, extend this implementation to the SC strategy and make employees aware of the sustainability practices to establish the concrete objectives. To move through the five steps of the roadmap and push a sustainable change, it is necessary to introduce changes to the organisational area by providing training for employees and suppliers, develop new organisational roles or units in charge of sustainability and define specific personal goals and incentives. This finding is relevant from a researcher's and a practitioner's viewpoint. For the former, research typically investigates operational and organisational practices separately, in different streams of literature. However, this paper demonstrates that a roadmap is a strategic tool and the two views should be adequately blended and strongly interconnected (Srivastava, 2007; Ahmed and Sundaram, 2012; Ageron et al., 2012). For the latter, this study suggests the importance of planning operational and organisational practices into companies jointly and consistently, without developing separate projects or teams for these two areas.

## 5. Conclusions

Although the importance of designing a proper sustainability roadmap is well recognised in the academic literature, some important gaps emerged, which this research has attempted to fill. Existing literature lacks contributions that analyse the adoption of a comprehensive practices-oriented roadmap for achieving sustainability objectives over time. Roadmaps that guide companies in the introduction of sustainability principles from both operative and organisational viewpoints are also lacking. By focusing on the fashion industry, the present work contributes to the scientific debate of designing a roadmap towards sustainability from an SC viewpoint. This paper merges the field of literature related to roadmap design with sustainable SC management to design a roadmap with an SC perspective, considering both environmental and social practices. This paper also reinforces the ideas presented in previous literature that organisations should address the issue of sustainability not only within their internal processes, but also by extending this vision along the SC. Moreover, this study makes a novel contribution to the literature through its joint consideration of social and environmental aspects and operative and organisational practices in a sustainability roadmap.

This case study contributes to the literature by demonstrating that the path toward sustainability is not always linear but is rather the result of a complex and dynamic implementation that has different levels of deployment in each step of the roadmap. Moreover, each step of the roadmap is categorised by specific practices and objectives that drive the passage from one step to another. In this way, the present paper contributes to literature streams about the motivations that drive companies and their SCs to undertake new sustainable models in their business.

For the managerial implications, the roadmap supports managers in selecting what practices should be implemented within the SC, with an incremental perspective. This study thus provides practitioners with a useful tool that guides their path toward sustainability. Since addressing sustainability issues is not fashion companies' core interest, they often lack of a structured approach. This research can therefore be useful for managers at the beginning of their path towards sustainability by directing them toward establishing the proper timing for implementing sustainable initiatives. The roadmap might also support managers that are already compliant with sustainability, but are willing to improve their strategy without a clear direction in mind. At the same time, the roadmap helps managers that have started implementing actions towards sustainability to make sure that any effort towards sustainability does not stall midway. This research is particularly relevant for managers to understand how to combine operational with organisational practices and environmental with social practices, without scattering energies and investments in too many directions.

This research has some limitations that provide directions for future research. The main limitations of this study pertain to the communication issue because the study fails to identify how companies communicate their sustainable commitment to the customers. The interaction between a sustainable roadmap and the theme of communication thus represents an interesting line of research. Moreover, while the present sustainability roadmap lacks the dimension of performance impacts, future work could conduct case studies of other sustainability-sensitive industries.

## Appendix A. : The coding of sustainability practices identified for the fashion industry, in terms of main practices, general practices, details and references.

| Sustainability practices | General practice | Details | References |
|---|---|---|---|
| Organisational | Definition of sustainability goals | • Definition of formal or informal policies with specific sustainability targets to be achieved<br>• Definition of Code of Conduct (voluntary or based on international guidelines)<br>• Economic incentives/compensations for managers related to sustainability objectives | De Brito et al., 2008; Gardetti and Torres, 2013; Li et al., 2014; Turker and Altuntas, 2014; Lueg et al., 2015; Choi and Li, 2015; Formentini and Taticchi, 2016; Winter and Lasch, 2016. |
| | Sustainability governance structure | • CSR committee<br>• Sustainability committee and managers<br>• Sustainability department<br>• Chief Sustainability Officer | Dargusch and Ward, 2010; Shen, 2014; Turker and Altuntas, 2014. |
| | Regular meetings on sustainability | • Internal meeting<br>• Meeting with external expert | Arena and Chiaroni, 2014; De Brito et al., 2008; Turker and Altuntas, 2014. |
| | Employee training | • Training on health and safety at work<br>• Training on environmental sustainability | Perry and Towers, 2013; Hyder et al., 2013; Shen, 2014; Turker and Altuntas, 2014. |
| | Increase organisational awareness of sustainability | • Ambassador<br>• Employee evaluation systems with sustainability indexes<br>• Raise awareness about sustainability beyond the workplace | Jang et al., 2012; Lueg et al., 2015; Fuentes and Fredriksson, 2016. |
| | Adoption of recognised sustainability standards | • Life Cycle Assessment (LCA)<br>• EU Eco-Management and Audit Scheme EMAS<br>• UNGC<br>• ILO<br>• Guidelines for Multinational Enterprises<br>• ISO 26000 | Nieminen et al., 2007; Lakhal et al., 2008; Lo et al., 2012; Ketola, 2012; Arena and Chiaroni, 2014; Turker and Altuntas, 2014; Cavalcanti Sá de Abreu, 2015; Winter and Lasch, 2016; Da Giau et al., 2016; Gardetti, 2017. |
| | Certifications | • LEED<br>• ISO 14000<br>• ISO 50000<br>• SA 8000<br>• EPD<br>• GOTS (Global Organic Textile Standard)<br>• Other (such as certified cottons and fibres) | Hustvedt and Bernard, 2008; González-Benito and González-Benito, 2008; Fulton and Lee, 2010; Lakhal et al., 2008; Lo et al., 2012; Caniato et al., 2012; Arrigo, 2013; Shen, 2014; Turker and Altuntas, 2014; Lueg et al., 2015; Choudhury, 2015; Da Giau et al., 2016. |
| | Communication and reporting | • Sustainability internally developed reporting<br>• Advanced solution for sustainability reporting (e.g., GRI, Environmental Profit and Loss, PEF)<br>• External communication (website, public report, advertising) | Nieminen et al., 2007; Kolk, 2008; Caniato et al., 2012; Turker and Altuntas, 2014; Shen et al., 2014; Lueg et al., 2015. |
| | Budget | • Micro-budgets for specific sustainability internal projects<br>• Fixed annual budget for sustainability projects | Lueg et al., 2015; Choi, 2016; Li et al., 2016. |
| | Benefit and organisational welfare | • Work safety<br>• Awards<br>• Medical benefit<br>• Flextime | Perry and Towers, 2013; Winter and Lasch, 2016. |
| | Philanthropic initiatives | • Support to the local community<br>• Support of specific project | De Brito et al., 2008; Perry and Towers, 2013; Da Giau et al., 2016. |
| Operational - Source | Purchase of sustainable material | • Eco-friendly/certified materials<br>• Recycle raw materials<br>• Eco-friendly packaging and shopping bag | Chouinard and Brown, 1997; Ciliberti et al., 2008; De Brito et al., 2008; Caniato et al., 2012; Cervellon and Wernerfelt, 2012; Das, 2013; Kraft et al., 2016. |
| | Suppliers selection | • Selection according to<br>o environmental and social indexes<br>o certifications obtained by suppliers<br>o geographical location<br>• Request of adoption of<br>o Restricted Substances List – RSL<br>o Manufacturing Restricted Substance List - MRSL | De Brito et al., 2008; Caniato et al., 2012; Turker and Altuntas, 2014; Jia et al., 2015; Winter and Lasch, 2016. |
| | Suppliers monitoring | • Supplier audit<br>• Self-certification<br>• Sanctions<br>• Extension of code of conduct to suppliers | Caniato et al., 2012; Cavalcanti Sà de Abreu, 2015; Choudhury, 2015; De Brito et al., 2008; Hustvedt and Bernard, 2008; Shen, 2014; Turker and Altuntas, 2014; Winter and Lasch, 2016. |
| | Supplier collaboration | • Supplier training<br>• Knowledge sharing with suppliers and actors of the SC | Caniato et al., 2012; Turker and Altuntas, 2014. |

(*continued*)

| Sustainability practices | General practice | Details | References |
|---|---|---|---|
| | Inbound logistics | • Internal environmental improvement of logistic (e.g. full load truck, CO2 emission reduction initiatives)<br>• Redesign of logistic network for environmental improvement (e.g. intermodal freight transport, new path configuration) | De Brito et al., 2008; Caniato et al., 2012; Choi et al., 2012; Li et al., 2016 |
| | Traceability | • External traceability | Lakhal et al., 2008; Perry and Towers, 2013 |
| | Supplier collaboration | • New processes and technologies development with suppliers and actors of the SC<br>• Joint development of projects oriented to improvement of sustainability practices<br>• Financial support to suppliers | Caniato et al., 2012; Choi, 2013; Pedersen and Andersen, 2013; Turker and Altuntas, 2014; |
| Operational - Make | Evaluation and consumption mapping | • Mechanical and/or chemical analysis on final product<br>• Internal energy, water consuming, air pollution audit | Lakhal et al., 2008; Caniato et al., 2012; Choi et al., 2012; Arena and Chiaroni, 2014; Ruppert-Stroescu et al., 2015; Cavalcanti Sá de Abreu, 2015; Da Giau et al., 2016; Winter and Lasch, 2016; Li et al., 2016. |
| | Introduction of eco-building solution for environmental improvement | • Energy efficiency improvement (e.g. LED, cogenerator)<br>• Renewable energy (e.g. solar, geothermal energy) | Caniato et al., 2012; Gardetti and Torres, 2013. |
| | Eco-friendly production processes and machines | • New clean technology for water saving and air pollution minimization<br>• Energy efficiency programs<br>• Manufacturing machinery renewal | Nieminen et al., 2007; González-Benito and González-Benito, 2008; Caniato et al., 2012; Lo et al., 2012; Turker and Altuntas, 2014; Jia et al., 2015; Li et al., 2016; De Angelis et al., 2017. |

## Appendix B. The sustainable practices implemented by each company of the SCs.

| Type | General practice | Specific practice |
|---|---|---|
| Organisational | Definition of sustainability goals | Formal (written) or informal policy |
| | | Code of Conduct |
| | | Economic incentives, compensations for managers |
| | Definition of sustainability governance structure | CSR committee |
| | | Sustainability committee and managers |
| | | Sustainability department |
| | | Chief Sustainability Officer |
| | Regular meetings on sustainability | Internal meeting |
| | | Meeting with external experts |
| | Employee training | Training on health and safety at work |
| | | Training on environmental sustainability |
| | Increase organisational awareness of sustainability | Ambassador |
| | | Employee evaluation systems |
| | | Raise awareness about sustainability |
| | Adoption of recognised standards of sustainability | LCA |
| | | EMAS |
| | | UNGC |
| | | ILO |
| | | Guidelines for Multinational Enterprises |
| | | ISO 26000 |
| | Certifications | LEED |
| | | ISO 14000/ISO 18001 |
| | | ISO 50000 |
| | | SA 8000 |
| | | EPD |
| | | GOTS |
| | | Other certifications |
| | Communication and reporting | Internal reporting |
| | | Advanced reporting |
| | | External communication |
| | Budget | Micro-budgets |
| | | Fixed annual budget |
| | Benefit and organisational welfare | Work safety |
| | | Awards |
| | | Medical benefit |
| | | Flextime |
| | Philanthropic initiatives | Support to the local community |
| | | Support of specific project |

(*continued on next page*)

(*continued*)

| Type | General practice | Specific practice |
|---|---|---|
| Operational - Source | Purchase of sustainable material | Eco-friendly/certified materials |
| | | Recycled raw materials |
| | | Eco-friendly packaging and shopping bag |
| | Suppliers selection | Sustainable vendor rating |
| | | Selection of certified suppliers |
| | | Selection according to geographical location |
| | | Extension of RSL |
| | | Extension of MRSL |
| | Suppliers monitoring | Supplier audit |
| | | Self-certification |
| | | Sanctions |
| | | Extension of code of conduct to suppliers |
| | Supplier collaboration | Supplier training |
| | | Knowledge sharing |
| | Inbound logistics | Internal improvement of logistic |
| | | Redesign of logistic network |
| | Traceability | External traceability |
| | Supplier collaboration | New processes and technologies development |
| | | Joint development of projects |
| | | Financial support to suppliers |
| Operational - Make | Evaluation and consumption mapping | Mechanical and/or chemical analysis on final product |
| | | Internal energy, water consuming, air pollution audit |
| | Introduction of eco-building solution for environmental improvement | Energy efficiency improvement (e.g. LED, cogenerator) |
| | | Renewable energy (e.g. solar, geothermal energy) |
| | Eco-friendly production processes and machines | New clean technology for water saving and air pollution minimization |
| | | Energy efficiency programmes |
| | | Manufacturing machinery renewal |

## Appendix C. A comparison of the sustainable practices adopted by first- and second-tier suppliers over time (yesterday, today, tomorrow).

| | Yesterday | Today | Tomorrow |
|---|---|---|---|
| BPA | Process and supply chain mapping and evaluation, Suppliers audit, energy saving solutions | Introduction of eco-building solution for environmental improvement | Introduction of eco-building solution for environmental improvement |
| T1A | Introduction of eco-building solution for environmental improvement, improvement of waste management | New processes, technologies and procedures development with suppliers (formal partnership with chemical producer for new process development), energy and water saving solution for production | New processes, technologies and procedures development with suppliers (development of new processes with less use of chemical substances), Introduction of eco-building solution for environmental improvement |
| T2A | Introduction of eco-building solution for environmental improvement, traceability, improvement of waste management | Internal energy audit, new processes, technologies and procedures development with suppliers (informal partnership with chemical producer for receipt improvement) | New processes, technologies and procedures development with suppliers (development of metal-free tannery process) |
| T3A | Energy saving solution for production, water saving solution for production, improvement of waste management | New processes, technologies and procedures development with suppliers (informal partnership with chemical producer for receipt improvement), water saving solution for production | New processes, technologies and procedures development with suppliers (development of metal-free tannery process), Introduction of eco-building solution for environmental improvement, traceability |
| T4A | Energy saving solution for production, Introduction of eco-building solution for environmental improvement, improvement of waste management, certification | New processes, technologies and procedures development with suppliers (informal partnership with chemical producer for receipt improvement) | New processes, technologies and procedures development with suppliers (development of metal-free tannery process), traceability |
| T5A | Improvement of waste management | New processes, technologies and procedures development with suppliers (informal partnership with chemical producer for receipt improvement) | New processes, technologies and procedures development with suppliers (development of metal-free tannery process) |
| T6A | Introduction of eco-building solution for environmental improvement, improvement of waste management | New processes, technologies and procedures development with suppliers (informal partnership with chemical producer for receipt improvement), Energy, water and air pollution saving solutions for production | Energy saving solution for production, new processes, technologies and procedures development with suppliers (development of metal-free tannery process) |
| T7A | Waste management solution, Introduction of eco-building solution for environmental improvement, energy saving solution for production, Philanthropic initiatives | new processes, technologies and procedures development with suppliers (informal partnership with chemical producer for receipt improvement), water saving solution for production, air emission saving solution for production | New processes, technologies and procedures development with suppliers (development of metal-free tannery process) |
| T8A | Improvement of waste management, definition of sustainability governance structure, Introduction of eco-building solution for environmental improvement | Employee training/supplier training, Introduction of eco-building solution for environmental improvement, energy, water and air emission saving solution for production | New processes, technologies and procedures development with suppliers (development of metal-free tannery process), Introduction of eco-building solution for environmental improvement, energy saving solution for production |

(*continued*)

| | Yesterday | Today | Tomorrow |
|---|---|---|---|
| T9A | Improvement of waste management, Introduction of eco-building solution for environmental improvement | Definition of sustainability goals and KPI, water saving solutions for production | New processes, technologies and procedures development with suppliers (development of metal-free tannery process) |
| NTPB | Training on health and safety at work; work safety; flexitime; support to local community | Eco-friendly certified suppliers; selection of suppliers based on geographical location; improvement of logistics; traceability | Traceability |
| SF1B | Code of conduct; REACH regulation; Eco-building development; Consumption mapping; Certifications | Renovation of operational facilities; Change of machinery; Supplier selection | Collaboration with suppliers |
| SF2B | REACH regulation; extension of code of conduct with suppliers; certification | Extension of RSL; Detox certification | Definition of internal organisational structure |
| KPC | Cleaner technologies; Consumption mapping; Eco-building development | Supplier selection; Internal improvement of logistics | Eco-friendly production processes |
| WF1C | Certification; REACH regulation; Eco-friendly production processes; Women and families support; Financial support to the local community; | Water savings measures; Eco-friendly processes; Supplier selection; Supplier audit; Internal reporting | Supplier collaboration |
| WF2C | REACH regulation; Certifications; LSR; Eco-friendly materials; Eco-friendly processes; Consumption mapping | Extension of LSR to the suppliers; Participation to Detox; Supplier audit and supplier selection; Organisational structure | Inbound logistics |

## Appendix D. The evolution during 2006–2017 in the implementation of sustainable practices by the focal companies.

| Starting year | Focal Company A | | Focal Company B | |
|---|---|---|---|---|
| | Practice | Description | Practice | Description |
| Before 2006 | Meeting with external expert (consultants, researcher) | Understanding of the "sustainability paradigm" with specific training and university project | Employee training | Training for employees about health and safety at work |
| | LCA at internal level | LCA for specific collection | | |
| | Code of conducts | Creation. 2013: update | | |
| | Internal environmental improvement of logistic | Green logistics with selected 3PL providers | Work safety | Practices in all the plant to assure work safety |
| | Definition of sustainability governance structure | Sustainability director and CSR/sustainability team | | |
| | Employee training | Leather craft training center | | |
| 2007 | | | Certification | REACH Certification |
| | | | Support to local community | Women and families support measures (Success Factor Family) |
| 2008 | Certification | 2008 and 2013: SA 8000.<br>2010 and 2013: ISO 14001 for the subsidiary in headquarter.<br>2012: RJC | Code of conduct | Formalization of an internal code of conduct and formalization of an internal formal policy towards sustainability |
| | | | Definition of sustainability governance structure | Incentives for managers |
| | | | Regular meeting on sustainability | Internal meeting about sustainability and preliminary project with external experts; in 2015 projects with universities; in 2016 projects with NGO |
| | | | Employee training | Training for employees about sustainability about preliminary practices; ongoing training in all the following years about new practices |
| | | | Monitoring of product performance | Mechanical and/or chemical analysis on final product |
| 2009 | | | LCA and ILO | Introduction of LCA for some key products; implementation of ILO |
| | | | Consumption mapping | Assessment of water, emissions and energy consumption |
| 2010 | | | Renewable energy | Renewable energy sources in one subsidiary |
| 2011 | Energy efficiency programs | Carbon Neutral project | | |
| | Benefit and organisational welfare | Economic bonus<br>Laundry service<br>Catering service for home dinner | | |
| 2012 | Introduction of eco-building solution for environmental improvement | New headquarter with 1.200 m^2 solar panel, rainwater recovery system, high efficiency and low emission heating and conditioning system, geothermal heating | Certification | ISO 15001 in the headquarter, ISO 14001 and ISO 50001. Extension to other plants in 2014, 2015 and 2016 |
| | | | Energy efficiency programs | First energy oriented programs in the headquarter; in 2014 and 2015 extension to other plants |

(*continued on next page*)

(*continued*)

| Starting year | Focal Company A | | Focal Company B | |
|---|---|---|---|---|
| | Practice | Description | Practice | Description |
| | Internal reporting | Sustainability report with target to be achieved by 2016 | Internal improvement of logistics | Use of low-emissions means of transport (shift to rail freight) |
| | | | Redesign of logistics network | Shipment optimization (adjustments of global transport routes) |
| | | | New clean technology for water cleaning and air polling optimization | Optimization of production processes to minimise wastes; water saving measures (renewal irrigation systems) |
| 2013 | Suppliers audit | 2013: beginning. 2014 and 2015: increase to most of supplier | Definition of sustainability governance structure | Establishment of a sustainability committee; Formalization of a sustainability department and of a Chief Sustainability Officer |
| | Suppliers/materials selection including sustainability indexes | Purchasing from key certified small-scale mines and responsible paper sourcing 2015: Responsible sourcing for precious skin and new procedure for an easily purchasing of certified traceable gold - Fully FSC-certified packaging containing 50% recycle materials | Eco-building solution for environmental improvement | DGNB Gold Certificate for sustainable building; Photovoltaic system in 2014; LED lights in 2015 |
| | New processes and technology development with suppliers and actors of the SC | Project for transform leather cutting into organic fertiliser. | Traceability | Traceability system for incoming finished goods; in 2014 extension to selected suppliers; in 2015 extension to all suppliers; in 2016 inclusion of environmental data |
| | Advanced solution for sustainability reporting | Introduction Environmental Profit & Loss | Philanthropic initiatives | Financial support for education of young people (Unicef) |
| 2014 | Traceability | Traceability for 2 models of bag | Supplier audit and self-certification | Suppliers' assessment through audits and through the implementation of self-assessment questionnaires |
| | Knowledge sharing with suppliers and actors of the SC | 2014 Introduction of new treatments with natural and metal free agents for man line and environmental footprint reduction project | LSR | Control over suppliers' use of hazardous substances |
| | | | Raise awareness about sustainability | Involvement of employees and suppliers to increase their sustainability awareness with vendor days and employee survey |
| | | | Advanced reporting | Involvement in the Product Environmental Footprint initiative |
| 2015 | Suppliers/materials selection including sustainability indexes | Responsible sourcing for precious skin and new procedure for an easily purchasing of certified traceable gold - Fully FSC-certified packaging containing 50% recycle materials | Eco-friendly packaging and shopping bag | Introduction of sustainable packaging; minimization of purchased packaging materials |
| | | | Training on environmental sustainability | Training program for the adoption of occupational health and safety standard in retail |
| | | | Water saving measures (renewal irrigation systems) | |
| | | | Redesign of logistics network | Tracking systems to coordinate means of transport |
| | | | Employee evaluation system | Definition of MBO for managers related to sustainability KPIs |
| | | | Fixed annual budget | Definition of a fixed annual budget devoted to sustainability projects |
| 2016 | | | Joint development of projects with suppliers | Collaboration with second-tier suppliers for APEO free processes |
| | | | New process development | Recycling/selling of processing waster and raw materials (pilot project on fabrics) |
| | | | LCA | Extension of LCA at the whole product categories |
| | | | Redesign of logistics network | Establishment of sustainable related guidelines for logistic and transport processes |
| | | | Financial support to suppliers | Adoption of SC Finance practices with Italian suppliers |

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