



Removing obstacles to the implementation of LCA among SMEs: A collective strategy for exploiting recycled wool

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ABSTRACT

Although SMEs often have financial restraints that prevent them from adopting proactive environmental strategies, they are increasingly being pressurized to adopt a more sustainable production pattern. We investigated how SMEs can respond to such external pressures, by studying the fashion industry located in an industrial cluster of Prato (Italy). The adoption of a life cycle assessment (LCA) is taken as representative of proactive environmental action, and this paper describes a scheme developed jointly by companies and the chamber of commerce in order to overcome the barriers usually faced by SMEs. The study thus demonstrates how SMEs can work with their major stakeholders in response to this external pressure. It also shows how the collaboration between actors operating in the same cluster can support the adoption of an LCA. The results contribute to the literature on institutional theory on effective approaches that support environmental practices.

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1. Introduction

An ever growing number of companies and institutions are increasingly concerned about the environmental impacts of industrial products and services and a huge amount of research is being carried on (Lozano, 2015). The research are focused on various aspects related to “environmental issues” and covers different disciplines, from management to economics, and from engineering to social sciences (Bansal and Hoffman, 2012).

The life cycle assessment (LCA) has also gained a prominent role (Guinée et al., 2011) and can be described as a quantitative methodology used to calculate the environmental impacts of products and services, taking into consideration the entire life cycle, from the extraction of raw materials to the end of life (Bauman and Tillman, 2004). LCA is recognized as an example of proactive environmental action which can be implemented by companies in response to environmental pressures (Hart, 1995) with significant

environmental and economic benefits (Teixeira and Pax, 2011; Molina-Murillo and Smith, 2009).

Customers and clients (Baden et al., 2009; Frankl and Rubik, 1999), public institutions (Williamson et al., 2006) and trade associations (Daddi et al., 2015) are pressurizing firms not to focus solely on in-house environmental impacts, but to consider the environmental impact throughout the entire life cycle of a product (Hanim Mohamad Zailani et al., 2012), i.e. involve the entire supply chain (Canning and Hanmer-Lloyd, 2001).

Although this approach is widely accepted and improves the sustainability of products and services (Almeida et al., 2015), there are some key issues during the implementation phase, particularly when the suppliers are SMEs, when multiple suppliers are involved, and when supply chains are complex (Daddi et al., 2015).

These characteristics are quite common in the case of multinational companies, which are often supplied by a multitude of SMEs with limited resources (Lee and Klassen, 2008). This situation is a challenge for SMEs, because although they do not have the financial or human resources to implement proactive actions, they are forced by the market to do so (Testa et al., 2012).

Although many authors have focused on the role of environmental aspects in supply chain management (Srivastava, 2007) and on the importance of the normative pressure exerted by large and

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multinational companies in spreading environmental best practices among companies (Friedman and Miles, 2002), few have focused on LCAs as an environmental practice and how SMEs respond to external demands (Testa et al., 2016a). As also emphasized by Bansal and Hoffman (2012), research on SMEs is particularly promising in helping to understand environmental management issues both for the scientific community and for the owners/managers of these firms.

Therefore, the first aim of this study was to explore what kind of pressures are felt by SMEs and how they can respond to them by adopting a specifically proactive environmental practice, such as an LCA.

Several authors have also emphasized that collaboration between SMEs facilitates the exchange of knowledge and, in turn, helps develop sustainability initiatives (Klewitz and Hansen, 2014). When co-operating in a cluster, SMEs, their business partners in the local supply chain and other stakeholders can operate in a network, both at operational and strategic levels, to develop innovative environmental practices, such as LCAs (Lee and Klassen, 2008). They can also generate technical and managerial innovation within the same network (Pittaway et al., 2004).

Although, the benefits related to cooperation and networking among SMEs and local actors have been well analyzed (Becattini, 1990; and Perrini, 2006), there is a lack of empirical studies that explore how SMEs exploit a life cycle perspective and use this to LCA to meet consumer demands for environmentally friendly products.

This study thus aims to answer the following research questions:

RQ1). *Is the lack of internal resources a barrier to SMEs in adopting proactive environmental strategies? How can companies with limited resources respond to external pressures?*

RQ2). *Do SMEs operating in clusters set up strategic alliances with major competitors, in order to address complex environmental problems by adopting proactive environmental practices?*

In order to answer these research questions, an action-research approach was applied. Action research is a participatory process where researchers combine theory and practice by active involvement in the creation of a change in a given context. (Eden and Huxham, 1996). Our case study describes the experience of a project called “Recycled Cardato”, i.e. recycled or regenerated carded wool, set up in the textile district of Prato (Italy) to gain insight into the behaviour of SMEs under pressure to implement sustainable practices. It focuses on how proactive environmental actions, exemplified by an LCA can be more effectively implemented through a collaborative “cluster approach”. This particular case captures the current focus on the circular economy applied at the local level, specifically involving the recycling of waste in production processes taking place in the same industrial sector (Daddi et al., 2015).

2. Theoretical background

2.1. Environmental pressures and SME adoption of environmental practices

The growing interest in companies on environmental issues is due to the various pressures exerted on them (Clarkson et al., 2011; Darnall et al., 2010). Daddi et al. (2016) explored how institutional pressures can stimulate the effectiveness of proactive environmental strategies in terms of innovative capabilities, market competitiveness and reputation. Seuring and Muller (2008) show that this kind of pressure is higher in industries characterized by a significant environmental impact and high visibility, however it has

now also been affecting sectors that have traditionally been recognized as less impactful.

Henriques and Sadorsky (1996) classified the environmental pressures exerted on companies as “internal” and “external”, according to the kind of stakeholder exerting the pressure. In their view, external pressures originate from all organizations and actors that are outside the boundaries of the company; whereas internal pressures are exerted by all the actors within the boundaries of the company. Stakeholders impose mainly coercive and normative pressures on firms’ internal variables, such as the organizational structure, and plant- and parent-company-specific factors influence the reaction of a firm to similar external demands (Delmas and Toffel, 2008).

According to Buysse and Verbeke (2003), firms adopting advanced environmental strategies often cooperate with some stakeholders, such as regulators and environmental NGOs, in the adoption of international environmental standards and voluntary agreements. They may also form strategic alliances with major competitors in order to address complex environmental problems (Buysse and Verbeke, 2003).

Focusing on SMEs, the scarcity of their resources has traditionally been seen as a barrier preventing the adoption of proactive environmental strategies that go beyond regulatory compliance. Several studies have found that the firm size has a significant effect on the degree of proactiveness, with larger organizations being more likely to adopt proactive environmental practices (e.g. Aragon-Correa et al., 2008; Buysse and Verbeke, 2003).

Darnall et al. (2010) investigated the effects of stakeholder pressures on the adoption of proactive environmental strategies by SMEs. Their empirical results show that smaller firms are more responsive to value-chain, internal, and regulatory stakeholder pressures, and that there is a positive relationship between stakeholder pressures and the adoption of proactive environmental practices and that this relationship tends to vary with the size. Lee (2009) found that environmental requirements and support from “buyers” (i.e. client companies in supply chains) were positively linked to their suppliers’ willingness to participate in green supply chain initiatives, especially when these suppliers were SMEs. A previous survey conducted by our research group (Testa et al., 2016a,b) revealed that external pressures and entrepreneurs’ attitudes are the most important predictors of environmental proactivity for SMEs.

Although the stakeholders and internal characteristics of a firm can be seen as drivers in the adoption of proactive environmental strategies, there are also barriers that prevent companies from adopting them. Murillo-Luna et al. (2011) identified both internal and external barriers. However, they affirmed that only internal barriers really prevent such proactive strategies (called “no-go” barriers) from being adopted and that SMEs are more subjected to these barriers.

Among the multitude of environmental practices, Simboli et al. (2015) highlight the increasing importance of LCA as a tool to support decision-making in manufacturing, also for smaller companies. However Heidrich and Tiwary (2013) highlighted the overriding barriers for SMEs in meeting the standards to conduct credible LCAs, in terms of accessibility to customised data and epistemological limitations.

In line with the above considerations, and since empirical studies on understanding how external pressures can offset and highlight a lack of internal resources, we formulated the following research question.

RQ1). *Is the lack of internal resources a “no-go barrier” for SMEs in adopting proactive environmental strategies? How can companies with limited resources respond to external pressures?*

2.2. Collective strategy approach to environmental management

SME networks are essential for addressing the systemic problems that underlie industrial ecology, enterprise resilience, and the sustainability of the global supply chain (Moore and Manring, 2009). SMEs especially those in a cluster with similar social and environmental issues and facing similar pressures from their external environment, may benefit from cooperation in relation to environmental issues (Testa et al., 2012).

The “collective approach” is based on the assumption that shared tools and synergies can be developed among SMEs operating in clusters, which encourage the adoption of environmental practices. By collaborating within a cluster of firms, SMEs are better able to tackle several environmental problems which can help boost their activities (Frey et al., 2013). Relational rents developed among SMEs operating in networks are increasingly recognized as a resource for competitive benefit in terms of a green economy (Frey et al., 2013). Most of the barriers and constraints stemming from SMEs’ lack of technical, human and financial resources can be overcome thanks to the synergies that emerge from cooperation.

Collaboration with business partners can greatly improve the environmental performance of products. In cooperative SME networks, the LCA can be used to implement eco-design and green marketing (Nakano and Hirao, 2011). Lozano (2015) argues that collaborative approaches can help SMEs build stronger and more sustainable strategies. Networks among institutions and SMEs also can be useful in supporting the application of LCAs in industrial clusters (Zanghelini et al., 2016). Collaboration is thus not confined to the supply chain but also includes non-traditional members, regulators, competitors and members of the community (Hoof and Thiel, 2014).

An LCA can be considered as environmentally proactive since it is characterized by a “beyond compliance” nature, and to be effective it needs inter-department and inter-organizational collaboration, the allocation of dedicated resources and to be integrated within the company policy. Co-locating suppliers in a concentrated geographical area might help lead to a faster adoption of greener practices (Bozarth et al., 2007). Therefore, an industry cluster might prove to be a powerful external enabler for SMEs (Lee and Klassen, 2008). Based on this evidence, we formulated the second research question.

RQ2). *Do SMEs operating in clusters set up strategic alliances with major competitors, in order to address complex environmental problems by adopting proactive environmental practices?*

3. The study context and research methodology

3.1. 1: the prato textile cluster (Italy)

The textile industrial zone of Prato is located in Tuscany (Italy) and covers an area of 700 km² including 12 municipalities in the provinces of Prato, Pistoia and Florence. It is one of the biggest industrial zones in Italy and one of the most important in the world in terms of the production of wool fabrics and yarns used for clothing and furniture (Dei Ottati, 1996). The Prato industrial zone includes approximately 8200 textile companies, the majority of which are SMEs, that employ more than 30,000 employees.¹

The major competitive strength of this zone is the high flexibility that enables its SMEs to rapidly respond to market demands.

An effective and robust network between the SMEs and the local institutions within the cluster guarantees the survival of the district in the increasingly competitive fashion market. However it also presents some difficulties in terms of environmental and innovation strategies, since the production is very fragmented (Piscitello and Sgobbi, 2004).

Recycled or regenerated carded wool (recycled cardato) is the traditional production of the district which can also be regarded as a recycling process. Carding is a specific way of processing fibers. The yarns and fabrics are produced reusing fibers obtained from recycling old or knitted clothing, and cuttings of new fabrics used in the garment industry. The important feature of the carding process is that it uses short fibers and different lengths, in very varied blends. The result is a yarn or fabric with a particular aspect that distinguishes it from the other types of yarn and fabric, known as worsted. In order to produce fabrics and yarns from old textile scraps, these scraps need to be processed to obtain fibers, named mechanical or recycled wool. The process from scraps to fibers is a genuine recycling process. The main phases of this process are the following (Magi and Ceccarelli, 2002):

- **Manual sorting.** The used clothing or cuttings of new fabrics used by the garment industry are sorted according to quality and color. Linings, buttons and zippers are removed from the clothing. This is an important aspect of the process where the “hands and eyes” of the expert worker are essential.
- **Carbonizing.** This process eliminates any vegetable impurities from the wool. Rags and cuttings are dry cleaned with hydrochloric acid, while new wool fiber is soaked in sulfuric acid. The treated fabrics or staples are then beaten to eliminate the carbonized particles.
- **Tearing.** In this process, the rags become fiber again by being mechanically torn and washed. The two operations are carried out in tanks where the rags are forced by the current of the water through two pairs of cylinders with steel teeth that tear them. The fiber is then dried and from here on it takes the name of mechanical wool.
- **Dyeing (optional process).** In this process, the mechanical wool is dyed according to the requirements of the market in terms of color. Often the recycled fibers are in an old fashioned color and are not suitable to produce fibers for current use by the fashion industry.

The mechanical wool obtained undergoes traditional processing to produce yarns and fabrics to be used for clothing. Whereas the process to produce the mechanical wool from textile scraps is unique, the processes to produce yarns and fabrics are the same one used to produce yarns and fabrics from virgin wool. Only minor adaptations are necessary according to the particular characteristics of the fibers obtained from the recycling process (e.g. length of the fibers).

The processes necessary to produce mechanical wool, yarns and fabrics are shown in Fig. 1. The processes shown in bold in Fig. 1 are externalized to at least one subcontractor for each process. To lower the risk connected to the externalization of works to subcontractors, usually at least two subcontractors are involved in each process (see Fig. 2).

As shown in Fig. 1, inside a cluster, commercial companies and subcontractors are the two main types of industrial actors (Becattini, 1990). Commercial companies have direct contact with the market and customers, however they do not perform any productive process internally but outsource all activities to subcontractors [who perform the work according to the requirements of the commercial companies]. Subcontractors are highly specialized firms that perform only one phase of the

¹ Source: Italian district national observatory, <http://www.osservatoriodistretti.org/node/282/distretto-del-tessile-abbigliamento-di-prato> (Accessed 12 August 2016).

production. It is not unusual for subcontractors to be more powerful than the commercial companies that outsource the work. This organization of the work can create great difficulties in the implementation of environmental and innovation strategies, since the companies interested in demonstrating their efforts to their customers are not able to influence the behaviour of subcontractors, who are usually responsible for all the productive processes and the majority of the environmental impacts associated with the products.

3.2. Research methodology

The action-research method was used to answer the two research questions of this study. Action research is a participatory process where the researcher combines theory and practice by the active involvement with practitioners, in the creation of a change in a given context. (Eden and Huxham, 1996). Action research is based on the strong cooperation between researchers and practitioners of the organizations involved. It relies on extensive interaction in order to solve a specific problem and generate new knowledge (Coghlan and Brannick, 2007).

As described by Eden and Huxham (1996), it consists of five main phases: i) diagnosing: identification of the problem; ii) action planning, iii) Implementation of the devised actions, iv) evaluation of outcomes, v) description of the lessons learnt.

We chose the Prato textile cluster as the context for this action research for three main reasons. Firstly, the cluster is composed mainly of SMEs who are involved in the supply chain of recycled wool for international and multinational clients. Secondly, the supply chain of this cluster is really complex, since it involves on

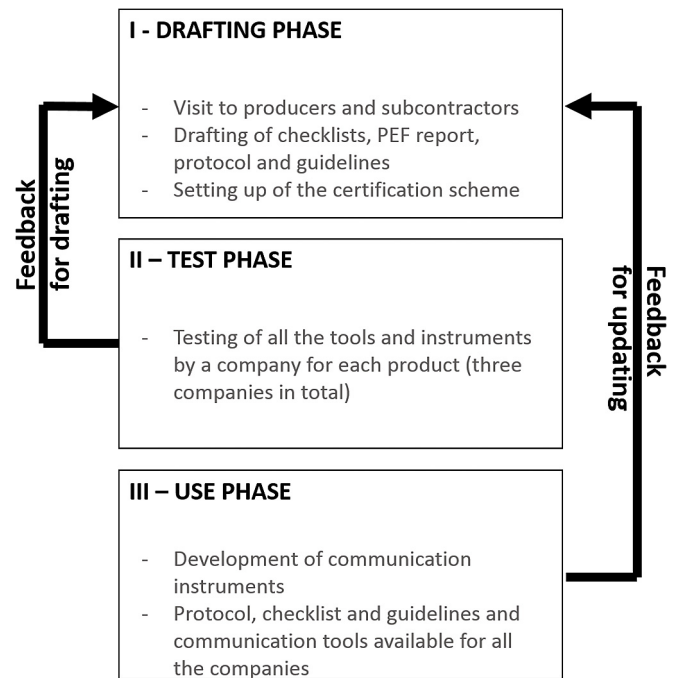


Fig. 2. Phases of the “Recycled Cardato” scheme.

average more than ten suppliers for each producer, with various degrees of power. Thirdly, the cluster is characterized by the high geographical proximity of the firms which increases the

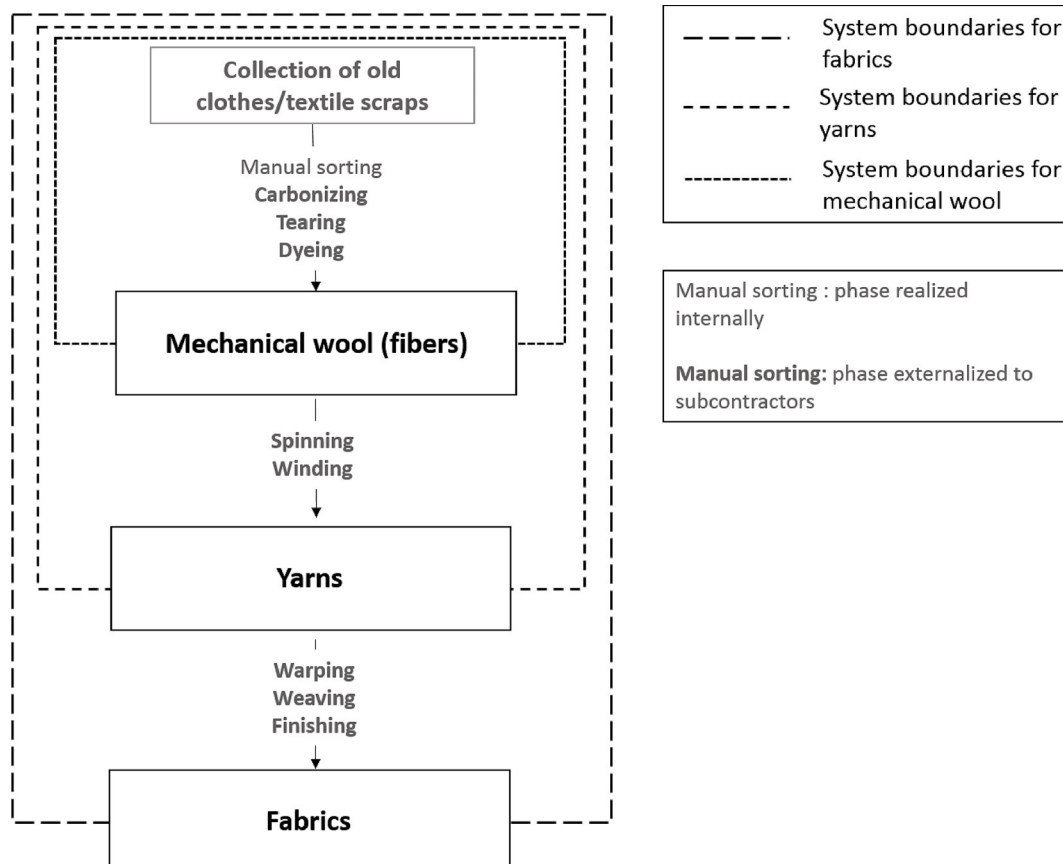


Fig. 1. Process for the production of mechanical wool, yarns and fabrics.

opportunity for collaboration and is a fertile ground for building trustworthy relations.

The action research project described, called “Recycled Cardato”, started in March 2014 and was completed in June 2016. It was aimed at applying an innovative method to support the implementation of an environmental management LCA-based cluster approach, in order to identify, improve and disseminate the environmental performance of a typical product of a cluster of SMEs using a collaborative approach.

The aim of this approach was to support SMEs in removing the barriers to an LCA and remodelling the specifications for the measurement of the product's life cycle in accordance with the new PEF (Product Environmental Footprint) methodology, issued by the European Commission in May 2013. The PEF was designed by the European Commission, based on LCA principles, in order to provide market actors with a clear and robust methodology for computing the environmental impact of products in terms of the entire life cycle. This methodology should remove misleading green claims from the market, provide reliable information to consumers, and avoid greenwashing behaviour.

A cluster approach was thus adopted, making it one of the first examples in Europe to use a simplified version of the PEF methodology to facilitate its adoption by SMEs located in a cluster. During the development of the project, a research team, composed of a scientific coordinator and senior and junior LCA specialists, participated in numerous meetings with the local chamber of commerce, trade associations, textile enterprises, local consultants and environmental verifiers. Field visits and informal conversations with local experts, managers and process operators were also conducted. Primary environmental data were collected through a structured check-list. There were frequent site visits and documents were obtained from other sources (company reports, procedures, statistical data bases) in order to cross-check qualitative data to increase research validity (Yin, 2002).

Semi-structured interviews were conducted, at the end of the project, with key actors and company managers in order to explore: i) the drivers and benefits of LCA practices; ii) the importance of the cluster approach in supporting this process; iii) and how this approach helps companies with limited resources. Finally, to test the reliability of the research method, findings were discussed with local stakeholders in the cluster during a public event.

4. Results

4.1. The “Cardato Recycled” action research project

As previously mentioned, SMEs operating in the textile district face all the difficulties that SMEs in other sectors traditionally face when approaching innovative management practices, such as: low level of knowledge and awareness, scarcity of time and of skilled personnel, scarcity of financial resources. In addition to these traditional barriers, SMEs in the Prato district have to deal with very fragmented supply chains, made up of other SMEs that face the same problems. The implementation of life-cycle based instruments thus seems impracticable, due to the difficulties in involving all the actors in the supply chain.

In order for companies in the Prato district to fulfil the increasing requirements for environmental information demanded by the markets and to enable them to easily identify opportunities for eco-innovation, the local Chamber of Commerce stimulated the cluster SMEs with a “green” competitive opportunity based on the EU PEF methodology.

The PEF methodology was published in April 2013 by the European Commission (European Commission, 2013 - Recommendation, 2013/179/EC) with the objective of reducing the

uncertainties connected to the calculation of the environmental footprint of products, based on the LCA methodology. The PEF encompasses the development of a set of rules for each product category (PEFCR), in order to further reduce the modelling choices connected to the calculation of the footprint. At present, a number of European pilots are developing PEFCRs, however the intermediate textile products are not included in the pilot phase.

Taking inspiration from the general approach adopted by the European Commission, in order to support the LCA application, based on PEF methodology, the Chamber of Commerce of Prato, with the collaboration of researchers and local experts, designed a local certification scheme named Cardato Recycled (Chamber of Commerce of Prato, 2014). This scheme combines requirements related to the LCA with additional environmental requirements. It enables participants to use a label that facilitates the dissemination of the environmental performance to clients and end-users. The label can be requested and obtained by producers of three different intermediate products that are part of the same supply chain: mechanical wool, yarns and fabrics made with mechanical wool. To obtain the “Cardato Recycled” label, the fibers, fabrics and yarns used for the intermediate product must comply with the following requirements:

- **A geographical requirement:** the products should be produced in the Prato district;
- **A minimum recycled content:** the products should be made with at least 65% recycled material (this applies only for yarns and fabrics since recycled wool is made from 100% recycled material);
- **A procedural requirement:** the products should have their environmental footprint measured according to the LCA methodology and, in particular, with the so-called “PEF” (Recommendation, 2013/179/EC). A specific requirement of the label is that, after having calculated the environmental footprint of their products, producers should communicate at least three of the many more impact category indicators foreseen by the PEF, i.e. water depletion, energy and climate change.

Once the label requirements have been fulfilled, SMEs voluntarily participating in the “Cardato Recycled” scheme can gain competitive advantages derived from all the collective actions that are organized periodically by the Chamber of Commerce, both at national and international levels. In addition to these marketing actions, companies can obviously use the label “Cardato Recycled” on their products and inform their customers.

The Chamber of Commerce involved the first two authors as LCA experts to draft the protocol, checklists and guidelines. A third-party certification body is also in charge of the requirement verification. During the “action research” reported in this paper, “Recycled Cardato” went through three stages: drafting, use, and testing (actual functioning + supporting documentation). Three pilot companies, one for each intermediate product, were involved in the test phase together with their own supply chain.

4.2. The methodological innovations for overcoming the difficulties of SMEs in LCA implementation

Scholars and practitioners agree about the additional difficulties that SMEs, compared to large enterprises, are faced with in adopting environmental practices (Frey et al., 2013). This greater effort is even greater in LCA implementation due to the technical knowledge required, the cost of the software, the need for environmental data from suppliers and clients, etc. (Iraldo et al., 2013).

These challenges were tackled in the design of the “Cardato Recycled” scheme in order to homogeneously calculate the

environmental footprint of the SME products. Specific guidelines were drawn up including information and examples on how to meet the additional product-specific requirements such as calculating the scope of the LCA model, the functional unit, the system boundaries and the list of impact categories to be analyzed. By setting up these guidelines, the Chamber of Commerce guarantees that the environmental footprints calculated by different producers of the same intermediate products (falling within the scope of the same protocol) are fully comparable.

The system boundaries for each intermediate product included in the Cardato Recycled scheme, together with the list of processes to be considered, and for which data should be collected, are illustrated in Fig. 1.

Methodological simplifications were also identified to overcome the specific difficulties that SMEs in the district of Prato face, mainly due to the particular industrial context in which they operate, i.e. the fashion industry, and to the fragmented nature of the production in the district.

The fashion industry is known to be a very dynamic environment with rapidly changing trends and styles and, consequently, rapidly changing products. These aspects represent a challenge for the successful implementation of an LCA. First of all, the LCA requires data collection on the production processes and on the supply chain. This is easily achievable when the product under study is already in production, but is a bit more difficult, but still possible, when (as often happens in the fashion industry) the product is in the design stage. An even tougher challenge arises from the mismatch between the time that it is usually required to perform a complete LCA and the lifetime of most fashion products (which is much shorter). In many cases, the results of an LCA study on a “cardato-based” product risk being only available to the producer when the product is no longer being manufactured. A final challenge in applying an LCA to fashion products is the need to reproduce the flexibility of this particular industry, which is needed in order to manufacture a very wide range of products for a wide variety of brands. This same flexibility also needs to be maintained when calculating the environmental impacts using the LCA.

In order to overcome time and flexibility problems, two aspects were investigated and implemented in the scheme:

- How should changing trends be dealt with?
- How should very differentiated products be dealt with?

Regarding the first point, of course neither the time-to-market, nor the lifespan of individual fashion products can be accounted for. Thus, the concept of the “family of products” was introduced into the “Recycled Cardato” scheme. This enables the applicant to group, under certain conditions, different products and calculate the environmental impacts with the LCA only for the worst performer in the family, thus conservatively representing the impact of all the other products in the same family.

In order to facilitate an extreme differentiation, the scheme was structured in a modular way, in order to reproduce exactly the production process for each eligible intermediate product.

The particular organization of the production within the district of Prato played a role in determining other features of the scheme. Each production phase is outsourced to at least one specialized subcontractor. Although this is undoubtedly an advantage for the flexibility of the SME producer, it becomes a disadvantage when we consider this aspect within the framework of the LCA. The LCA requires the collection of data to cover the complete life cycle of the products. In the case of recycled carded products, this means that data from all the subcontractors need to be collected in order to calculate the environmental impact. Unfortunately, this is not feasible in the majority of cases because the commercial companies

(those that legally own the product) often have less power than the subcontractors and are not able to collect data from them. Even assuming that the main manufacturer (that is the fabric owner but it does not carry out any phase of the production process) is able to collect data from the subcontractors, the situation may be difficult considering that there may also be four or five subcontractors for each process outsourced. In addition, problems of know-how, competition and pricing can also arise when asking for data from subcontractors.

In order to overcome this practical difficulty, without affecting the full traceability of the product, a trade-off was established. The “Cardato Recycled” scheme requires the suppliers to be identified that supply 100% of the mechanical wool used, and that specific data should be collected from the suppliers that supply at least 70% of the mechanical wool for the eligible product. The remaining percentage can be modelled using average data from the district's database. This facilitates the traceability of the raw material used to produce yarns and fabrics. If the suppliers are already certified in the same scheme, commercial companies do not have to collect data from suppliers of mechanical wool. Regarding sub-contractors, the scheme requires specific data to be collected from the subcontractors that produce at least 50% of the amount for the specific product for each process outsourced. The remaining percentage can be modelled using average data for each process contained in the district's database. To make this possible, average data for processes created within the district are calculated and made available to all the companies (both the main manufacturers and the subcontractors).

5. Discussion

This paper aims to contribute to the literature on the effectiveness of the collaboration among many local actors in the adoption of environmental initiatives by SMEs. The paper uses an action research approach to the application of the LCA by SMEs located in the cluster of Prato in order to highlight the efficacy of both collaborative action, and the use the LCA as a communication and marketing tool.

The design and implementation of the scheme to calculate the environmental footprint of carded products in the textile cluster of Prato, in fact, was only possible thanks to the establishment of a network among the companies and between the companies and the local institutions, here represented by the Chamber of Commerce. According to Roos et al. (2016) this approach simplifies the collaboration between actors in a specific sector through a common understanding of the sustainability challenges and, particularly, by way of a facilitated and shared set of resources in the adoption of the LCA.

The main driver in the development of the “Recycle Cardato” scheme was the growing interest in the environmental issues shown by the customers, mainly consisting of big and multinational companies. However, this kind of pressure has been mainly experienced by those SMEs with direct contacts with customers and who have to respond to the new trends in market demand. The same pressures however, were not experienced by the suppliers of mechanical wool, who only have contacts with local commercial companies, nor was it experienced by the many different subcontractors and outsourcers. Whereas the producers of mechanical wool are keen to respond to the indirect “green” requests from commercial companies (who produce yarns and fabrics from mechanical wool), this is not the case with subcontractors. Although the survival of all the supply chain depends on the satisfaction of the final customers, the behaviour of the two types of companies in the project was different. The subcontractors initially refused to collaborate, whereas the suppliers of mechanical wool agreed to be

partners in the “Cardato Recycled” from the beginning of the project.

This can be explained by the different bargaining power between the different types of companies. Subcontractors are even more powerful than their clients (commercial companies), due to their size and limited number (it is unlikely that they will lose clients as a result of not participating in this kind of project). The situation of the mechanical wool producers is very different. They have recently been experiencing strong competition from other kinds of materials and saw a competitive edge in the recycled nature of the intermediate products they offer (and its consequent reduced environmental impact) with respect to other producers of different raw materials. Although the pressure exerted by final customers was strongly felt by the Prato commercial companies, they were not able to react appropriately, due to a lack of internal skills and knowledge of the environmental instruments (e.g. the LCA or an already existing green label) available, and to a lack of financial resources that made hiring an external consultant unaffordable. In order to respond to these external pressures, the intervention of the Chamber of Commerce was decisive. Having collected the same perceptions on the growing “green demand” from the market from many companies operating in the cluster, the Chamber of Commerce decided to start organising meetings to better understand what kinds of requests the commercial companies were receiving and whether it was possible to propose a collective action to respond to this need. As has happened in many other cases (see Nakano and Hirao, 2011), the final decision was to use an LCA to improve the product environmental and competitive performance.

As a result of the isomorphic external pressures exerted on the commercial companies by the market, and of the informal meetings organized by the Chamber of Commerce, the “Cardato Recycled” scheme was set up.

The lack of internal resources, although proven to be a limitation to the isolated action of only one firm, was overcome thanks to the stipulation of an informal agreement with competitors and a formal agreement with the Chamber of Commerce. The stipulation of such contracts enables a scheme to be designed that can be used by individual firms in order to meet the requirements of their clients at a reduced cost and effort. A summary of the features of the scheme are reported in Fig. 3, which highlights the elements of the scheme that contribute to the reduction of costs, efforts and to the

increase in the reliability of the results.

6. Conclusions

This paper reports the findings of an action research project carried out in the textile cluster of Prato in order to investigate if and how SMEs react to external pressures related to environmental aspects through collaboration with the Chamber of Commerce of Prato and other local actors. The paper confirms the ideas of Bozarth et al. (2007) by providing a practical example on how local cooperation, supported by the presence of an industrial cluster characterized by geographical proximity, can act as a powerful external enabler for SMEs in the adoption of innovative environmental practices.

In addition, the paper also explains how technical difficulties related to the implementation of the LCA can be overcome thanks to a collaborative strategy. The certification scheme described in this study, is based on various documents that explain how the whole system is managed by the Chamber of Commerce and how the environmental impacts of the product are calculated. The most important decisions are related to the structure of the supply chain and how reliable results are possible even if the access to all the primary data from suppliers is not possible. This system represents a feasible affordable solution for SMEs for the implementation of a proactive environmental strategy and for responding to the pressures from costumers, thus overcoming the common barriers faced by this kind of company.

The case provides an important example of how it is possible to simplify the relation between suppliers (in this case commercial companies) and their clients regarding environmental issues. In fact, the SMEs located in the industrial district are usually suppliers of multinational or large companies who are committed to environmental issues and who implement supply chain strategies to monitor and evaluate suppliers. To maintain their role as suppliers, SMEs need to fulfil the requirements of these companies by also providing environmental and consumption data. The participation of an SME in the Cardato Recycled scheme guaranteed the availability of these data, which were also certified by a third party.

This study also confirms the findings of Holt et al. (2001): the external pressure exerted by the customers proved to be decisive in driving SMEs to implement proactive environmental actions, such as the implementation of the LCA. However, these pressures alone would not have the same outcome without various enablers. The adoption of the LCA is taken as representative of a proactive environmental action and the structure of the scheme developed jointly by local enterprises and the chamber of commerce is described as a unique case.

Whereas a driver is defined as a factor that initiates and motivates firms to begin the environmental management capabilities (EMC) development process, an enabler is defined as a factor that assists firms in achieving the development of EMC (Lee and Klassen, 2008). In this case, enablers are represented by the involvement and proactivity of the Chamber of Commerce and the possibility of reducing costs and effort. The reduction in costs and effort connected to the LCA was possible thanks to the interest of multiple firms of the same type who decided to work together in order to respond to market demands. However, this reduction in costs and effort would also be possible by other suitable ways for different contexts and sectors. For instance, Lee and Klassen (2008) suggested that increasing environmental support by the buyers is expected? as a critical compensation for the deficient internal resources of SME suppliers'.

In our case, fashion companies are very interested in the LCA approach and are asking for environmental data throughout their supply chain (Caniato et al., 2012).

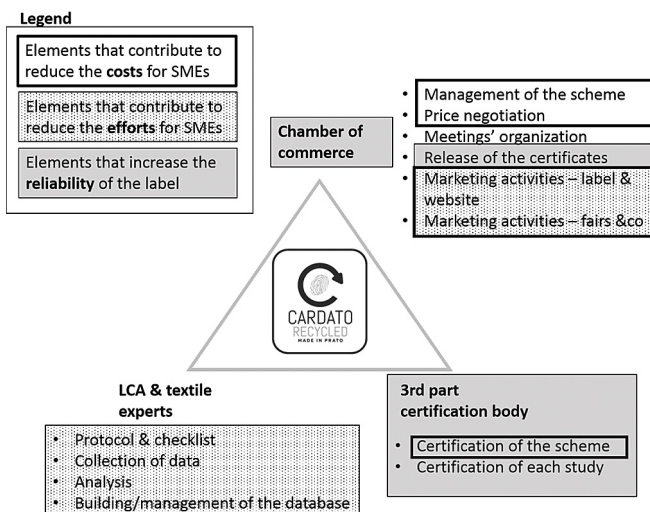


Fig. 3. Elements of the scheme that contribute to the reduction of costs and efforts, and to the increase in the reliability of the results.

In the Prato textile district, the Cardato Recycled scheme has provided a great opportunity to leverage innovative local practices and policies, while at the same time enhancing the competitiveness of the cluster area.

The stakeholders involved in the Recycled Cardato project have enthusiastically endorsed the qualification scheme, because the results of the LCA adoption represent new environmental and business opportunities for SMEs. The collaborative approach adopted by the actors in this project was a driver to implement the new LCA practices in local SMEs. Glisovic et al. (2015) reported that an important element for the successful dissemination of LCA practices in SMEs could be a national program which would take advantage of the Chamber of Commerce network and its infrastructure to extend the adoption at different levels. This overview helps in understanding the need for environmental business offers and that collect important local benefits to the entire supply chain involving SMEs. Therefore, collaboration is a significant concept for the LCA implementation within supply chains and networks (Hoof and Thiel, 2014).

Since the project only recently ended and the certification scheme is still in a start-up stage, an in-depth analysis of outcomes in terms of the improvements in environmental and competitive performance of adopters was not possible. A future comparative case study should be carried out to explore the perceived benefits of adopters.

The present study did not explore that factors that facilitate the development of reliable relations among SMEs and local actors. Future studies, based on a survey approach, could investigate the determinants for building reliable and long-term relations and how the LCA adoption has contributed to their development.

In summary, this study demonstrates how SMEs can collaborate with their major stakeholders to respond to external pressures, and how such a collaboration between actors in the same cluster can support the adoption of an LCA. The results contribute to the literature on institutional theory on approaches that are effective in supporting environmental practices.

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