

Redefining fashion: eco-design and circular economy practices in Romania

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ABSTRACT – REZUMAT

Redefining fashion: eco-design and circular economy practices in Romania

This study examines best practices in eco-design within six Romanian textile companies, highlighting their commitment to environmental sustainability, circular economy principles, social responsibility, and education. These companies implement innovative solutions such as the use of durable and recycled materials, waste reduction strategies, eco-friendly dyeing processes, and ethical labour practices. Their approaches align with global trends in sustainable fashion, demonstrating how the industry can transition toward more responsible production and consumption models. By adopting similar strategies, fashion companies can greatly minimise their ecological footprint and promote a more sustainable and socially responsible future.

Keywords: eco-design, good practices, environmental sustainability, circular economy, social responsibility, education

Redefinirea modei: practici de eco-design și economie circulară în România

Acest studiu examinează cele mai bune practici în domeniul eco-design-ului în cadrul a șase companii textile românești, subliniind angajamentul lor față de sustenabilitatea mediului, principiile economiei circulare, responsabilitatea socială și educația. Aceste companii implementează soluții inovatoare, cum ar fi utilizarea de materiale durabile și reciclate, strategii de reducere a deșeurilor, procese de vopsire ecologice și practici de muncă etice. Abordările lor se aliniază cu tendințele globale în moda sustenabilă, demonstrând cum industria poate face tranziția către modele de producție și consum mai responsabile. Prin adoptarea unor strategii similare, companiile de modă își pot minimiza considerabil amprenta ecologică și pot promova un viitor mai sustenabil și mai responsabil din punct de vedere social.

Cuvinte-cheie: eco-design, bune practici, sustenabilitate, economie circulară, responsabilitate socială, educație

INTRODUCTION

The textile industry has increasingly recognised the necessity of transitioning from a linear economy to a circular economy model, which emphasises sustainability through the principles of reduce, reuse, and recycle. This shift is essential to mitigate the significant environmental impacts associated with textile production and consumption, such as resource exhaustion, environmental pollution, and waste generation. The concept of eco-design plays a pivotal role in this transition by integrating sustainability into the design process, thereby enhancing product life cycles and minimising waste [1, 2]. Eco-design in textiles involves creating products that are both visually appealing and eco-friendly throughout their life cycle. This includes considerations for material selection, production processes, and end-of-life management. For instance, the development of green textiles, which employ sustainable materials and processes, is a strategic goal within the circular economy framework [2]. Furthermore, the implementation of eco-design principles can lead to increased product durability and recyclability, which are crucial for reducing the overall environmental footprint of the textile industry [3, 4].

Recent studies highlight the increasing pressure on the textile industry to adopt eco-design principles to reduce its environmental impact. For instance, Schumacher et al. [5] conducted an assessment of the textile industry's circular economy landscape in the United States, identifying key challenges and opportunities for sustainable practices. Tripa et al. [6] emphasise that technical textiles exert significant ecological pressure, necessitating solutions that integrate sustainable materials and production processes. Another study suggests that customised clothing represents a viable strategy to address textile waste by minimising overproduction and unsold stock [7]. Additionally, Indrie et al. [8] propose an innovative algorithm for textile waste arrangement to optimise waste management in the industry. Spyridis et al. [9] introduced an autonomous AI-enabled industrial sorting pipeline for advanced textile recycling, showcasing innovative solutions to enhance recycling efficiency. Similarly, the European Environment Agency (2022) [10] underscored the role of design in Europe's circular economy, emphasising product durability, repairability, and recyclability. Furthermore, the European Commission (2022) [11] outlined comprehensive strategies to create a greener, more

competitive textile sector through its EU Strategy for Sustainable and Circular Textiles.

The circular economy model encourages innovative business practices that prioritise sustainability. This includes the adoption of circular business models that focus on product life cycle management, reverse logistics, and extended producer responsibility [12, 13]. Such models not only enhance the eco-efficiency of textile production but also foster collaboration between manufacturers and designers to create sustainable products [12]. For example, the integration of digital technologies and data analytics can improve transparency and traceability in textile supply chains, facilitating better waste management and recycling efforts [14].

A recent report by Reconomy [15] examined the current state of the circular economy in the fashion industry, exploring its challenges, benefits, and pathways for increased sustainability. Challenges remain in the widespread adoption of circular economy practices in the textile sector. Barriers such as lack of awareness, inadequate infrastructure for waste management, and the complexity of textile recycling processes hinder progress [13, 16]. Moreover, the fast fashion industry exacerbates these challenges by promoting overconsumption and rapid product turnover, leading to increased textile waste [17]. Addressing these barriers requires a concerted effort from all stakeholders, including policymakers, industry leaders, and consumers, to foster a culture of sustainability and circularity [18].

In conclusion, the integration of eco-design principles within the circular economy framework is crucial for the sustainable transformation of the textile industry. By prioritising sustainability in design and production processes, the industry can significantly reduce its environmental impact while promoting economic viability and social responsibility. Continued research and innovation, alongside collaborative efforts among stakeholders, will be essential to overcoming existing challenges and attaining the full potential of a circular textile economy.

ECO-DESIGN AND CIRCULAR ECONOMY PRACTICES IN EUROPE AND ROMANIA

Eco-design plays a crucial role in advancing sustainability within the fashion and textiles industry. Across Europe, numerous companies and initiatives have embraced eco-design principles, integrating circular economy strategies, responsible material sourcing, and innovative production techniques to reduce environmental impact. According to the European Environment Agency (EEA), eco-design strategies have significantly contributed to reducing waste and energy consumption across various industries [19]. Countries such as Sweden, Germany, and the Netherlands [20] have been at the forefront of implementing sustainable design principles, promoting extended product lifecycles, recyclability, and responsible consumption.

Spain has also made significant progress in integrating eco-design and circular economy strategies into the textile industry. Ecoalf, a Spanish brand, is widely recognised for its commitment to sustainability by transforming marine plastic waste and other recycled materials into high-quality fashion products. By adopting a closed-loop production system, Ecoalf minimises its environmental impact while setting an example for responsible textile manufacturing. Similarly, Recover™, a Spanish textile recycling company, plays a crucial role in reducing waste by producing high-quality recycled cotton fibres. Their innovative approach to fibre regeneration aligns with circular economy principles and contributes to reducing the need for virgin cotton.

In Romania, eco-design is gaining momentum as companies integrate sustainability into their production processes. Bi Eco Fashion, for instance, exemplifies how local businesses are incorporating environmentally friendly materials and ethical manufacturing practices. Another notable example is ALTRNTV, a Romanian initiative that embraces circular economy principles by promoting upcycled fashion and responsible consumer behaviour. The ALTRNTV shop not only offers sustainable clothing but also raises awareness about eco-friendly practices, demonstrating how small businesses can drive change in the industry [21]. Additionally, research collaborations and European initiatives, such as Erasmus+ projects (2023-1-ES01-KA220-HED-000157440-Supporting Entrepreneurship in Eco Design-FASHION.ED), have supported the development of innovative solutions in the sector. Studies on traditional Romanian textiles and their potential for sustainable applications also contribute to the growing body of knowledge on eco-design [22].

In this study, we intend to highlight best practices from Romanian companies, focusing on key aspects such as environmental sustainability, circular economy principles, social responsibility, and education. By showcasing these examples, we aim to inspire further adoption of eco-design strategies that contribute to a more sustainable and responsible fashion industry.

EXAMPLES OF GOOD PRACTICES IN ECO-DESIGN IN ROMANIA

The identification of eco-design best practices within Romania's textile sector was conducted by analysing 6 businesses from different parts of Romania that integrate sustainable strategies into their operations. These best practices were identified based on information provided directly by the companies, as well as publicly available data from company websites, press articles, and academic publications.

The selection of the companies in this study was based on their documented and evident involvement in sustainable practices within the fashion and textile industry. The selection criteria focused on the following aspects: using eco-design principles in their product development processes; implementing strategies

that align with models of the circular economy; demonstrating social responsibility through fair labour practices or assistance for vulnerable groups; participating in sustainability-related educational or awareness-raising initiatives; and having publicly available information (websites, articles, reports) that details their sustainable practices were the main focus of the selection criteria. These criteria ensured that the selected companies – Atelier MERCI, Atelierul de Pânză, Bi ECO FASHION, Îte Urbane, Poartă-mă cu flori, and REDU – represent relevant and diverse examples of best practices in eco-design within the Romanian textile sector.

The study used a qualitative, thematic framework based on four major pillars of sustainable development in the fashion industry to analyse and classify the best practices used by the chosen companies: *environmental sustainability*, which includes the use of eco-friendly materials, waste reduction, and non-polluting production processes; *circular economy* principles, which include reuse, repair, recycling, upcycling, and closed-loop systems; *social responsibility*, which includes ethical labour practices, marginalized group inclusion, and community engagement; and *education* and awareness, which focuses on educating customers, staff, or the general public about sustainability issues.

This analytical framework made it possible to compare the businesses' practices in an organised manner and made it easier to find recurring themes, creative strategies, and transferable models that other

textile industry players could use as a source of inspiration.

The selected six companies exemplify sustainable textile production and are from various regions of Romania.

Atelier MERCI [23] – Operating under ALTRNTV LIFESTYLE SRL, Atelier MERCI is a Bucharest-based sustainable fashion brand that prioritises ethical production over fleeting fashion trends. Its mission centres on creating garments that respect customers, the environment, and the community by using organic and natural materials with minimal environmental impact.

Atelierul de Pânză is a social enterprise developed by the Viitor Plus Association, established in 2009 in Bucharest with the objective of providing sustainable alternatives to plastic bags. The initiative not only focuses on reducing plastic waste but also fosters social inclusion by employing individuals from disadvantaged backgrounds [24].

Bi ECO FASHION [25] – a niche artisanal fashion brand dedicated to reducing waste and pollution. The brand limits production to a small series of four pieces per design, cutting fabric manually using traditional tailoring techniques. Since all production is handled internally, they can be reproduced upon request, preventing excessive production and resource depletion. This strategy is in line with the company's dedication to eliminating waste and promoting responsible consumption.

Îte Urbane [26] – a Bucharest-based prêt-à-porter creative studio launched in early 2020 with a commitment to producing high-quality, durable garments in an environmentally and socially responsible manner. The company integrates recycling and upcycling into its production process, ensuring that its designs minimise waste and promote sustainability.

Poartă-mă cu flori [27] – a sustainable fashion brand from Neamţ County, known for both its eco-friendly materials and its unique natural dyeing techniques. The company uses plant-based dyes derived from saffron, roses, marigolds, and oak leaves, following the traditional Romanian method of *boițul cu buruieni* (herbal dyeing).

REDU [28] – is a pioneering initiative offering ethical and sustainable alternatives to conventional fashion. Based in Iași, REDU upcycles textile waste collected from local garment manufacturers to create new products, each carrying a unique story of transformation.

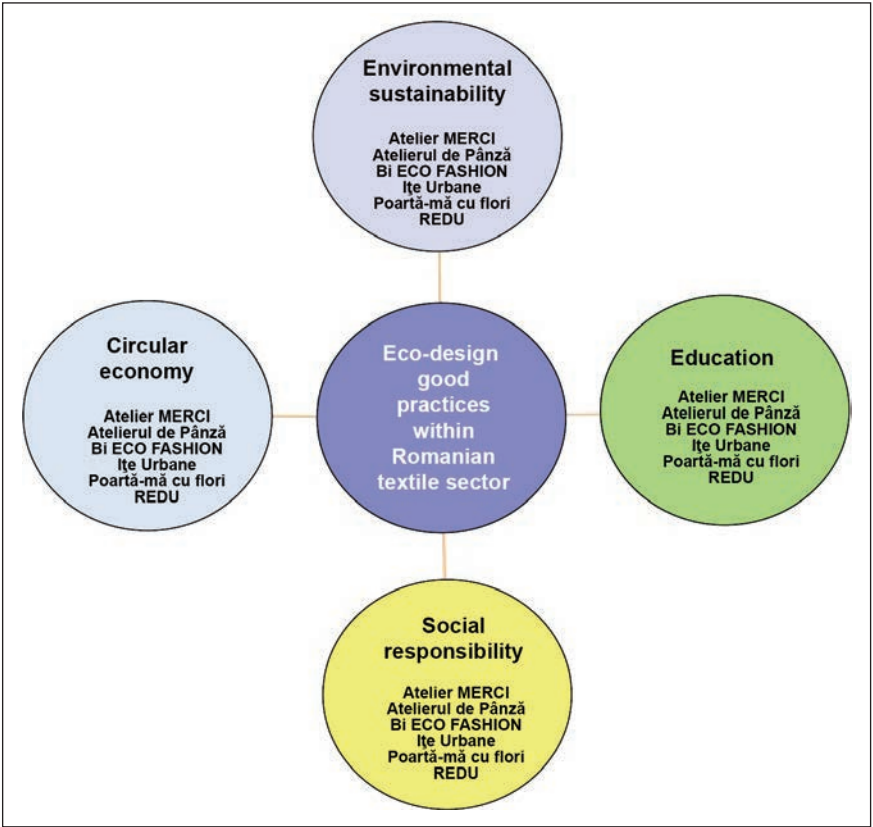


Fig. 1. Eco-design good practices in the Romanian textile sector

As the first entrepreneurial project in Romania dedicated to systematic textile waste reduction, REDU plays a crucial role in promoting circular fashion. The identified best practices within these companies can be categorised into four main areas, which will be explored in detail in the following sections.

Environmental sustainability

Atelier MERCI produces all its garments exclusively from natural or organic materials, such as organic cotton, hemp, and linen. The fabrics used are certified by the Global Organic Textile Standard (GOTS) and OEKO-TEX. The company prioritises sustainable packaging, using locally produced biodegradable, plastic-free packaging with natural adhesives instead of synthetic or petroleum-based ones. By minimising transportation distances from production to customers, *ATELIER MERCI* effectively reduces its carbon footprint.

Atelierul de Pânză is committed to reducing environmental impact by offering 100% cotton tote bags and Puzzletex accessories, which serve as sustainable alternatives to plastic bags. The company prioritises the use of natural, biodegradable materials, ensuring that its products contribute to lowering plastic waste and pollution. By promoting reusable, long-lasting textile solutions, *Atelierul de Pânză* encourages consumers to adopt eco-conscious shopping habits, reducing their reliance on disposable plastic.

Additionally, the company's manufacturing process follows sustainable practices, minimising textile waste and ensuring ethical production standards. Through these efforts, *Atelierul de Pânză* actively supports environmental conservation by offering practical and responsible solutions for daily consumption.

Bi ECO FASHION manufactures all its coloured garments using ECONYL® regenerated nylon, a material derived from waste such as discarded fishing nets, fabric scraps, and carpets destined for landfills. This fabric is infinitely recyclable, enabling endless possibilities for designers and consumers. The company's environmental impact is further minimised as production is centralised in a single location, reducing transportation emissions. Moreover, the high-quality materials ensure that the garments are long-lasting.

At Îte Urbane, the design, production, and distribution processes are all centred on resource efficiency and waste minimisation. The company predominantly utilises natural fabrics sourced from Romania or other European countries. Their garments are designed to be durable both in terms of quality and timeless style. Production is limited to small batches and, whenever possible, made-to-order to prevent overproduction and stock accumulation. The dyeing process incorporates plants harvested from the company's garden or purchased locally. Furthermore, all products are packaged in reusable cotton tote bags to eliminate plastic use. As part of its commitment to sustainability, *Îte Urbane* plants a tree for every order placed.

Poartă-mă cu flori distinguishes itself not only by using sustainable materials but also through its unique dyeing techniques. The brand employs plant-based dyes derived from saffron, roses, marigolds, oak leaves, and other botanicals. This process is based on a traditional Romanian method called "boitul cu buruieni" (herbal dyeing).

REDU is a pioneering initiative in Romania, committed to reducing textile waste by transforming discarded materials into high-quality, sustainable products. The company follows an innovative upcycling model, collecting fabric scraps from garment factories in Iași and repurposing them into clothing, accessories, and utility items. Each product tells a unique story of transformation, emphasising the potential of textile circularity.

A key aspect of *REDU*'s environmental sustainability strategy is its zero-waste approach. By carefully selecting and reusing textile scraps, the company minimises the environmental footprint associated with textile production and disposal. This practice not only reduces landfill waste but also extends the life-cycle of materials that would otherwise be discarded.

Circular economy

Atelier MERCI recycles products received from donations. By reintroducing these products into the manufacturing process, the company contributes both to reducing the need for raw materials and to reducing the amount of textile waste.

Atelierul de Pânză integrates circular economy principles into its business model by focusing on waste reduction and resource efficiency. The company ensures that textile scraps are repurposed, contributing to a zero-waste production cycle (the decor cushions are filled with textile waste obtained by shredding textile waste, which, due to their very small size, cannot be used even at *Puzzletex*). Even the label used is made of recycled cardboard. *Puzzletex* accessories, made from leftover fabric, exemplify this commitment by transforming excess materials into new, functional products instead of discarding them. This approach not only minimises environmental impact but also fosters a sustainable consumption mindset, encouraging customers to shift towards responsible, long-term use of everyday items.

Bi ECO FASHION focuses on implementing circular economy principles from the product design phase. In their design process, they have eliminated, as much as possible, rigid components such as accessories and buttons to facilitate easier deconstruction and recycling. Their minimalist approach incorporates mono-material designs that enable easy disassembly, while the use of threads with the same composition as the garment's fabric supports an endless supply loop by reintegrating discarded textiles into the production cycle. In addition to recycled materials, they also utilise natural fabrics such as linen.

Îte Urbane emphasises sustainability by creating clothing that is both durable and timeless, reducing the need for frequent replacements. They prioritise the use of natural and biodegradable materials,

ensuring that their products have a minimal environmental footprint. Additionally, through its take-back program, *Ite Urbane* encourages consumers to return used goods for recycling or repurposing, thereby keeping materials in circulation and reducing waste.

Poartă-mă cu flori focuses on creating garments that are designed for longevity and adaptability. They utilise modular design approaches, allowing pieces to be easily adjusted or updated, which extends the product's lifecycle. The company also engages in local production, minimising transportation emissions and supporting the local economy. By sourcing materials responsibly and promoting repair over disposal, *Poartă-mă cu flori* aligns with circular economy strategies designed to reduce waste and optimise resource utilisation.

By integrating sustainable practices throughout all aspects of its operations, from material sourcing to product design and community engagement, *REDU* sets a strong example of how the fashion industry can transition toward a circular economy while reducing its environmental impact. The company has implemented its system for collecting used clothing items and offers repair and alteration services to extend the lifespan of textile products. Additionally, it has developed over 50 new product patterns, based on which nearly 6,200 new products have been created using recovered textile materials from the most local and natural sources possible.

Social responsibility

Atelier MERCI supports various medical and social causes and is actively involved in charitable initiatives. For example, it donates *Atelier MERCI* products to the Romanian Red Cross, which sells them in its charity shop, *Bine Boutique*. The funds raised are used to support the medical and social causes of the *MERCI Charity Boutique* association.

Atelierul de Pânză is strongly committed to supporting and integrating people with disabilities – more than half of its employees are individuals facing such challenges

Bi ECO FASHION demonstrates social responsibility by promoting ethical production practices and fair labour conditions. Their commitment to using recycled and natural fabrics supports not only environmental sustainability but also responsible manufacturing processes that prioritise workers' well-being. By integrating ethical principles into their operations, *Bi Eco Fashion* contributes to a more socially responsible fashion industry, advocating for fair treatment and sustainable livelihoods within the textile sector.

Ite Urbane operates as a slow fashion atelier, focusing on ethical principles. They utilise natural fibres and collaborate with local tailors who are fairly compensated. Their mission is to develop high-quality, sustainable products crafted with care and respect for both the environment and people, reflecting a deep responsibility towards future generations.

Poartă-mă cu flori is a Romanian brand that emphasises traditional craftsmanship and cultural heritage. They collaborate with local artisans to create unique,

handcrafted clothing items, thereby supporting local communities and preserving traditional skills. Their approach fosters social responsibility by promoting cultural sustainability and providing fair economic opportunities to artisans.

The team at *REDU* has donated over 65% of the collected clothing to vulnerable individuals, while a quarter of the items, after sorting and cleaning, have been resold at very low prices to community members. Additionally, they have organised multiple editions of the *Solidarity Bazaar* and participated in numerous alternative fairs, where vulnerable individuals received free clothing, footwear, blankets, and other essential items.

Education

By providing 100% cotton bags, *Atelierul de Pânză* enable people to use fewer plastic bags. Additionally, they have developed a social webshop that gathers and sells products from various social enterprises in the country. This platform not only markets eco-friendly products but also builds and shares knowledge about branding, social impact, and other relevant topics, thereby educating both consumers and producers about sustainable

Atelier MERCI guides marginalised Romanian craftspeople on transitioning to sustainable packaging and improving waste recycling processes, thereby educating and supporting small artisans in adopting eco-friendly practices.

While *Bi ECO FASHION* primarily focuses on creating eco-friendly products, it contributes to raising awareness among consumers about the importance of environmentally responsible choices in the fashion industry.

Ite Urbane prioritises respect for both the environment and people. The company focuses on producing durable, high-quality garments made from natural fibres and collaborates with local tailors who receive fair compensation. Their mission also includes educating consumers about the value of slow fashion and the importance of responsible consumption.

Poartă-mă cu flori conducts a range of activities designed to increase awareness about the importance of reducing textile waste, particularly that of highly polluting fabrics. Additionally, the company promotes sustainable alternatives to chemical dyeing by advocating for the use of plant-based textile dyeing techniques.

Education is at the core of *REDU's* activities, both through consistent online communication and numerous events aimed at fostering a collective environmental mindset and enhancing local community awareness of the social and environmental impact of the textile and apparel industry. The organisation has participated in and hosted multiple events, including the *REcreation* workshop, all designed to promote production and consumption models that minimise waste through sharing, reuse, repair, refurbishment, and recycling of existing materials and products as extensively as possible.

Additionally, REDU draws attention to the negative environmental impact of the textile industry, both from a producer and consumer perspective, while educating the public on how to extend the lifespan of clothing, how to properly collect and repair garments, and how to repurpose them into useful items.

DISCUSSION

The practices observed in these Romanian companies are consistent with global trends in sustainable fashion. It is very important to use eco-friendly materials, implement recycling programs, and adopt sustainable dyeing and finishing processes to minimise environmental impact.

Furthermore, research on the Romanian textile industry underscores the significance of integrating sustainable practices to enhance competitiveness and align with international standards. The adoption of eco-design principles not only contributes to environmental sustainability but also offers economic advantages by meeting the growing consumer demand for responsible fashion choices [29].

The companies studied demonstrate a strong commitment to *environmental sustainability* through various practices. For instance, Atelier MERCI utilises sustainably produced vegan and organic materials in their handcrafted clothing, minimising the environmental impact associated with conventional textile production. Similarly, Îte Urbane focuses on creating durable, high-quality products using natural fibres, thereby reducing reliance on synthetic materials and promoting biodegradability.

These practices align with broader industry trends emphasising the use of eco-friendly materials. According to a report by ECOS, implementing eco-design requirements for textiles is crucial for mitigating the environmental impact of fast fashion and promoting the use of sustainable materials [30].

Several of the companies integrate *circular economy* principles into their operations. REDU embodies circularity by collecting used clothing, offering repair services, and designing new products from recovered textiles, thereby extending the lifecycle of materials and reducing waste.

These initiatives reflect a growing emphasis on upcycling and recycling within the fashion industry, with upcycling increasingly embraced by luxury brands and businesses as a strategy to address environmental concerns and promote sustainability.

The companies studied also demonstrate a commitment to *social responsibility*. Atelier Merci provides guidance to marginalised Romanian craftspeople on transitioning to sustainable packaging and improving waste recycling processes, thereby supporting small artisans in adopting eco-friendly practices. This strategy not only enhances environmental sustainability but also fosters social equity by empowering disadvantaged communities.

Such practices are consistent with findings from a study on sustainable manufacturing in Romanian SMEs, which emphasises the importance of integrat-

ing social and environmental considerations into business operations to achieve long-term success [31].

Education plays a pivotal role in promoting sustainable fashion practices among consumers and industry stakeholders. REDU places education at the core of its activities, engaging local communities through educational initiatives and workshops that encourage a shift toward conscious consumerism.

These educational efforts align with broader industry movements aimed at raising awareness about the environmental impact of fashion.

CONCLUSIONS

Approximately 10% of global greenhouse gas emissions are generated by the fashion industry. The processes involved in textile production are significant consumers of water and electricity, and the chemical dyeing of garments has a substantial impact on the contamination of freshwater resources. Therefore, businesses that produce products from textile waste and dye fabrics with plant-based materials could serve as an inspiration for making the industry more sustainable.

The study highlights that the main eco-design strategies in textile companies in Romania include the use of sustainable materials in production processes, the creation of products designed to last over time, ensuring durability in terms of resistance, quality, and style. It also emphasises the collection of textile waste, which, after sorting, is either reintroduced into use through donations to disadvantaged individuals or transformed into other types of textile products that are then reintegrated into the economic circuit. Reducing the environmental impact of textiles is achieved by preferring to create items from natural, recyclable, and biodegradable materials sourced locally or as close as possible to minimise the negative effects of transportation. This includes the use of sustainable, biodegradable packaging that is plastic-free and uses natural adhesives instead of synthetic or petroleum-based ones, as well as the ecological dyeing of products using plants. The social responsibility of the studied firms is demonstrated through safe working conditions and fair wages, the promotion of ethical labour standards, care for disadvantaged individuals through donations, and the employment of people with disabilities. Particular attention is also given to educational and informational activities aimed at raising awareness in the local community about the social and environmental impact of the textile and garment industry. This includes the importance of reducing textile waste (especially polluting waste), learning how to extend the life of clothing items, understanding how they should be collected, repaired, and transformed into useful items, and the possibility of replacing chemical dyeing of textiles with plant-based dyeing, which does not negatively affect the environment.

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