

REUSE OF CLEAN WASTE FROM THE FASHION INDUSTRY IN SUSTAINABLE DESIGN DEVELOPMENT WITH A FOCUS ON SOCIAL RESPONSIBILITY

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ABSTRACT

The present article relates the concept of design in the social sustainability focusing on the environmental issues in vogue, threatened under an excessive generation of clean solid wastes during the mass production of products from existing industries, textiles and footwear, towards the consume of today's societies. The search for imminent solutions face to this problem are centralized on the sustainable design, aiming essentially the co-design based on upcycling principles and the methods of modular design, between designers and young adults with intellectual or physical disabilities, with intention to make creative proposals for new fashion products more sustainable, differentiated and with added value. In this mode, comes up the importance of a more social and ethical design, giving the participatory opportunity between amateurs and professionals to minimize the resources and production processes, and optimizing the life cycle of the product.

Keywords: *sustainability; sustainable design; co-design; clean waste; upcycling; modular design*

1. INTRODUCTION

Currently we live in an era of inexorable trends in relation to the difficulties of the global economy, to the restrictions of an ecological disaster, to the scarcity of resources and to the social problem that we are constantly facing. A main cause of the continued deterioration of the global environment is the vertiginous growth of consumption and waste generation from industrial production, compromising the several natural cycles in the world [1].

However, the reorganization behaviour of is irrefutable and requires involvement of both the social component as the market so that we can achieve sustainable development model, to ensure the welfare of the human kind, without threatening the future. Face of this new paradigm, one of the big challenges for the fashion industry, particularly the textile and footwear industry, is to find effective measures for the clever placement of solid waste, which minimizes or eliminates the impact on the environment, as also allow lower costs for the treatment of such waste. The resulting waste from the fashion (textile, clothing, footwear) industry is one of the most responsible of the generation of worldwide waste, extremely harmful to the environment, threatening the natural cycles, which are dumped.[2].

On the other hand, the issue of solid waste has been considered as an opportunity to the socioeconomic system of materials integrated sustainable management of natural resources. Many of the discarded waste are with high quality raw materials and it can be reintroduced in the production chain to be transformed into a new product [3].

Considering that proposing sustainable solutions to problems of solid waste is a key factor for achieving sustainable development, the present study, has the main objective to propose sustainable solutions for consumer awareness through reintegration of solid waste, "how it is possible to replace the clean waste in a new production cycle?", reusing minimal resources,

optimizing the product-life-cycle through low-impact processes and appealing socio-economic values with extreme social responsibility.

1.1 Sustainability and Environmental Guidelines

The awakening of consciousness from the social component for consumption of today is one of the most libertarian moments of human life, because the notion of change tries to transcend the individual interests translating a new view of the world, reflecting the responsibility of each person in the plural and full collective values construction to ensure human well-being and respect for all forms of life in its various manifestations [4].

That way, the sustainability is part of a strategic system from the union between different but complementary dimensions, environmental, economic and social to environmental conservation, culture and social wellbeing [3].

To achieve this goal, governments are responsible for integrating the economic, social and environmental concerns in the formulation of macroeconomic politics. In this regard, the development of micro-economies - small and medium-sized enterprises - should follow and be subject to local agendas created and applied according to the specific characteristics of production systems and consumption of each region [5].

In relation to waste policy, industrial waste is one of the most responsible for the generation of waste and the harmful damage to the environment, especially the physical and chemical waste from manufacture of leather articles sector [1]. Therefore, we can say that the physical growth of an economy is inevitably related to the formation of waste in the future.

With regard to the fashion industry, in which the footwear sector is inserted, and according to The ONG Britannic "*Forum for the Future*" [6], excesses are associated with competitiveness and volatility of fashion, which transform the clothing and shoes in a very highly disposable good.

The Europe stands out in leather production, particularly in countries like Italy, Spain and Portugal [7], with a strong tradition in the production of leather (tanning), and usually has a privileged position in the international fashion circuit, with shoes and clothing made of leather.

In the European footwear industry, more than 70% of produced footwear incorporates animal leather tanned with chromium (Stage 1¹), generating, inevitably, toxic waste into the environment [2]. The disposal of such waste in landfill, although it is becoming increasingly difficult because of environmental constraints, remains the preferred management option, leading to waste of all resources contained in leather [2].

Currently, these wastes have been the subject of hundreds of studies and analyses in order to make it possible to reuse or recycling [2].

This performance metric is part of the scope of dissemination of a Minimization of Waste Policy and recovery of the 3Rs - Reduce, Reuse and Recycle, which is the most promising way for industries in an attempt to move towards to the development sustainable model, able to minimize the negative environmental impact and contribute to the resources of the commons goods that are ecologically sustainable, economically efficient and socially equitable [8].

1.2 Valuation of the Solid Clean Wastes

1 Stage 1 - It refers to the high level of toxicity in the environment [2].

The recovery of the solid waste is especially given in the early stages of design and management activities to the extent that the initial design decisions may have a very significant impact on the sustainability [9].

At the stage of manufacturing design of new industrial products, the recovery of waste should be taken into consideration when secondary raw materials are used, allowing these then can be reintroduced into the production cycle with added value [10].

That way, in pre-selected phase, the selected materials are cleaned, identified and classified to obtain a process of reuse or recycling with quality. Pre-consumer materials can be waste and sub-products of a certain production cycle or waste and surplus generated externally of the original production process [11]. This production model opens up to global and local economic growth, from the concept of upcycling, which creates products with increased environmental value [9].

In the footwear industry, many of the waste disposed are quality raw materials that can be reintroduced into the production chain, becoming a new material or product. The process of shoes manufacture comprises a set of materials that are worked by technological processes, which may be divided into two parts - the upper and the lower shoe. The production process in the shoe industry is characterized by its discontinuity, with the production flow occurring between five distinct stages: design, modeling, cutting, sewing, assembly and finishing. In each of these steps, the operations performed are divided into several stages according to the type of footwear produced, the size and structure of the company.

The untapped leather scrap during the cutting stage is considered a clean solid waste with high quality and is also the one with the best performance in relation to its reuse in the product system [12]. The reintegration of such waste can occur through the approach of ecodesign and the principle of upcycling in Production Life Cycle - PLC, being this reintegration already defined and planned from the early stages of the product system. The Figure 1 shows the production cycle, as well as the identification of the stage where you can select the clean residue for possible future reuse.

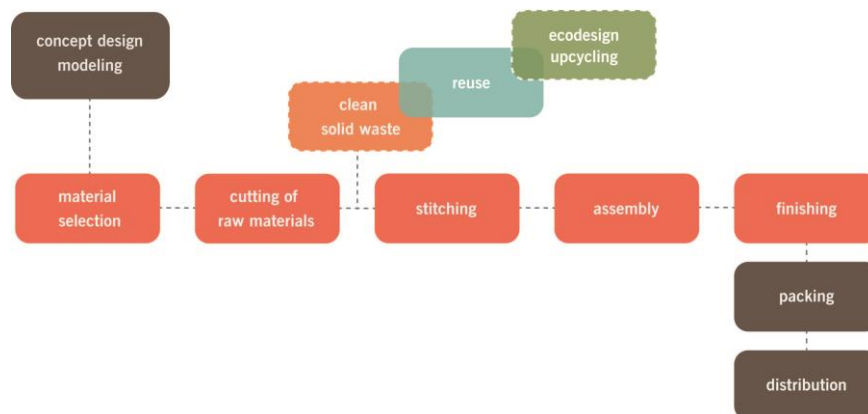


Figure 1. Footwear production cycle

This model allows to reflect on the reprocessing of the product and/or waste discarded to create a new quality product, which can be applied to different objects and markets.

Notoriously, the upcycling method defined as reprocessing or reuse of materials, i.e., reintroduction of waste in the product life cycle from the design process, and opening opportunities for new market segments. The characterization of this product may be significant for its environmental adding value, but also for its functional, aesthetic and emotional aspects, with different future projections [9].

This tool, within the fashion industry, allows reusing a lot of clean waste, eliminating many problems associated with these. Its implementation in fashion tries to respect aspects such as material selection, local production and distribution, calling for internal solutions in the industry relating to sustainability issues [13]. In this way, this method can provide positive solutions in industry for more sustainable forwarding steps and environmentally, socially and economically friendly.

2. SUSTAINABLE DESIGN

The sustainable development is based on the principles of solidarity among all for the preservation of natural resources provided by nature, with necessary requirements which respect the proper use of renewable resources, making the best possible in the application of non-renewable resources, minimizing amount of waste produced [3].

Within these parameters, the process of sustainable design becomes a more complex and diffuse procedure as the conception of the product design outlined in Figure 1, since the concern usually responds to an production economically feasible, environmentally friendly and socially just [14].

This concern in the sustainable development process of the product ends up integrating in the fashion system. And in this scenario of integrating sustainability into environmental, economic and socio-cultural level, it can be understood on the basis of various existing terminologies: eco-fashion, green fashion, ethical fashion, slow fashion, among others. [15] Regardless of the use of terminology, it is a set of attitudes and values, which aim to promote good social and environmental practices, include the reduction of production and consumption. However, the application of sustainability in fashion does not say with certainty that the new products will be fully sustainable, since their production cycle implies somehow an impact, however minor, in ecological or social system.

In the sustainable product design field, it's looking for eco-efficiency as a strategy to design products and services with less use of resources and produce less waste and pollution [16]. One of the approaches to eco-efficiency in ecodesign [17] is the integration of theory of the 3 R's - Reduce, Reuse and Recycle, previously mentioned. This theory covers upcycling downcycling techniques that define the design and product development [18]. The interdependence of the factors involved in the development of sustainable product is essential for a positive outcome of a project, supported by the ecodesign which integrates the methodology in design concepts to respond at the needs of the environment [19]. Taking these aspects into consideration, the leather wasted in the footwear industry and deposited on waste dumps is, however, characterized as a potential residue for reuse; it can be converted into new raw materials and products. However, due to the high leather toxicity level, the recycling process is not the most suitable for the recovery of waste. In this case, the concept of upcycling is presented as an efficient eco alternative to the reintegration process this type of waste in the lifecycle of new materials or products with better quality and environmental value.

This concept has been gaining more importance in the development of products more sustainable, allowing the gradual development of ecological consciousness of those who produce and those who consume the products.

2.1 Co-Design

Looking ahead to the near future assuming as probable new methods and practices applied to sustainable design, it is important to involve mutual cooperation between the market and consumers, involving the designer and the user to reinvent new ways to design. For the authors Sanders and Stappers [20] co-design demonstrates the collective creativity, shared

by two or more persons, being applied to the entire length of a design process. From this collective look, the co-design and sustainability merge here as an architectural design proposal for shared design and as a solution for certain immediate demand, favoring the improvement of the possible phases of durability and longevity of the product's life, including the scopes economic, environmental, but mainly social component. Today, in sustainable design for fashion, the slow design approach - as a set of principles and slower processes of production - has been providing some beneficial contributions to the reduction of process resources and consumption of material, good and services. This set provides a designer proximity vision with the consumer, allowing an affective consume relation in the way of the conception of product with ecological added value and potential future impacts. The complicity of this affective relationship brings out the application of the possible strategy of dematerialization, i.e., think carefully the products or the production in order to enhance the existing social concerns today. In this sense, the designer has an important role, as choosing and applying the selection materials in sustainable development such as choosing the energy sources necessarily for the operation of the product [3].

In recent years, the existence of a growing interest from designers to integrate different methods of sustainable construction in their creative practices can be proven according to some authors [21; 22]. Among methods and beyond the upcycling concept, stands out the modular design - used to create patterns of two and three dimensional surfaces and contributes to the development of new products with sustainable focus associated with the reuse of materials, generally by flexible and multi-combinable bases [23]. This is a method based on the construction of geometrical structures flooring and forms tessellation in the modular system, giving a second "skin" to the material, and allowing the creation of products through this ability to reinvent a more efficient eco system, with affectionate attachment [24].

3. EXPERIMENTAL PART

Through literature exploratory and empirical research, it was initially collect specific data of production waste within the textile and footwear industries, and in a second phase, it was applied the sustainable design concept through the reuse of clean waste from those industry's (felt and leather) to create patterns of surfaces, based on the method of modular design and principles of upcycling, which can be converted into raw material to the composition of new visual solutions applied in clothing, fashion accessories and home decoration items [12].

From the modular design concept it was explored the organization from a set of discrete components that could be developed independently and, which subsequently could be interconnected giving rise to new products with visual aesthetics appealing [25].

The materials explored in this work were wool felt and leather, and technologies used were laser cutting machines and hydraulic presses with cutting modules (metallic).

Explored and optimized the process, it become easy and accessible the development of the design surfaces by hand, through the principle of social sustainability and from the involvement of co-design between designers and young people with physical and intellectual disabilities with special educational needs of AIREV Association (Association for Integration and Social Rehabilitation of Disabled Children and Young People Vizela).

The work was carried out according to dynamic of workshops where the surface design (assembly of surface patterns) was created, according to the sensitivity of young people with intellectual disabilities from the institution, and then assembled parts as fashion accessories, resulting in very interesting and differentiated products.

4. RESULTS AND DISCUSSION

As a result of this work, were obtained different surface designs from the principles of modular design and principles of upcycling, reusing essentially the clean wastes from the textile industry and footwear (felt and leather), as shown in Figure 2.

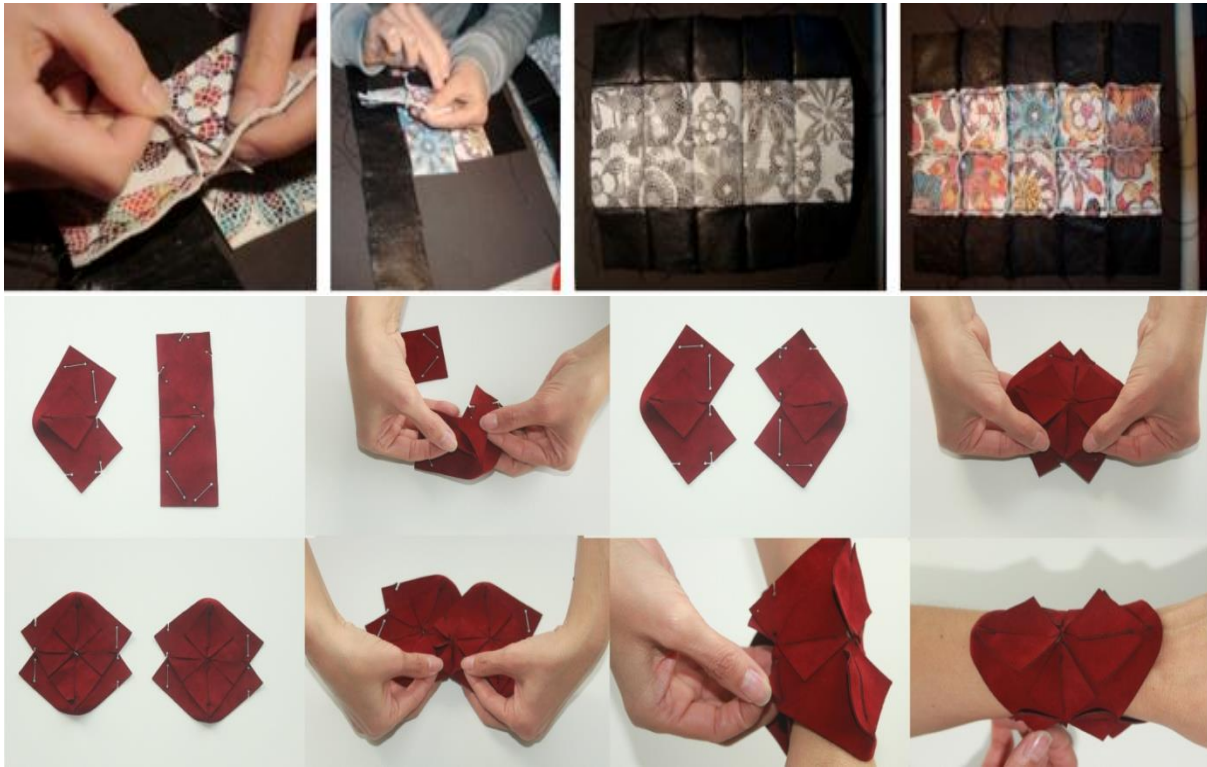


Figure 2. Process of surface design creation from clean waste (upcycling and modular design)

In a first phase of work, was developed products according to the principles of upcycling, resorting to the use of techniques such as stitch between geometric modules and creative selection in the combination of modules different colour, resulting various surfaces to the construction of fashion accessories (bags, etc.).

In a second stage of investigation, the creation of products based on the modular design, was applied the fitting technique between modules, without resorting to stitching process, but through small cuts in the modules, connecting each module together forming a part or fashion accessories (bracelets, etc.). This manual working method allows the developing of physical-motor and intellectual abilities of young adults, and the framework of the methodology of social design was entirely directed to responsible design, highlighting the interests and needs of the social and cultural conditions, as an essential activity in sustainable development this work.

The activation of creativity within social groups and institutions through social inclusion provides a contribution to social growth and more ecological in creating new products and design processes, and promotes dissemination of diverse knowledge and awareness, trying to eliminate the deep social stigma related to disability in our society. The figure 3 shows some pictures of the work in the workshop at the AIREV (Association for Integration and Social Rehabilitation of Disabled Children and Youth of Vizela, Portugal).



Figure 3. Work in workshops with young adults with intellectual disabilities

5. FINAL CONSIDERATIONS

In an attempt to find a solution to the reuse and conversion of clean solid waste from the footwear industry, it was applied the methodological study related to sustainable design, thus integrating the eco design and principles of upcycling, slow design and concept modular design for new proposals of products with social and environmental value added. These methods mainly aimed the recovery of waste and included the concept of "minimum stock" and "maximum diversity," which allows the optimization of the product life cycle, with minimal use of resources and production processes possible.

The proliferation of strong ideas and projects in this field, alert to the danger of a currently excessive consumerism, It allows captivate a new society which mainly appreciates ethics and social values, not by charity but by the valorisation of small changes in the social enhancement, and mainly for the differentiation and recognition of new products with added value. On the other hand the differentiation of results achieved in this project leads us to question the essence of creative thinking when working with these young people, and to rethink their more active role in today's society which is intended to be more sustainable and with strong changes in lifestyles, through a co-design.

Under the sustainable design of a social nature, all of these actions are characterized as a possible way to contribute to the development of the local economy in the surroundings of the textile and footwear, creative industries, small groups of occupational therapy or associations of rehabilitation and integration of people with various types of disabilities.

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