

State of the art on Life Cycle Assessment on fashion industry

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This paper aims to analyze the state of the art of circular economy and Life Cycle Assessment made on fashion industry so far.

In fact, in the fashion system something is going dangerously out of control, and today the textile sector is one of the main culprits of global pollution. The clothing industry, in fact, is the second most polluting in the world, after that of oil. At a global level, the figures speak for themselves and tell of huge consumption: 98 million tons per year of non-renewable resources, 93 billion cubic meters of water, and about 1.2 billion tons of CO₂ emissions into the atmosphere. 60% of the textile fibers used are synthetic and, among these, polyester, which is the most widespread, requires, only for European consumption, more than 70 million barrels of oil (Ellen MacArthur Foundation, 2017).

Still remaining in Europe, according to the estimates of the European Environment Agency, the production of the sector in 2017, for each EU citizen, a consumption equal to 1.3 tons of raw materials, 104 cubic meters of water with the emission of 654 kilos of CO₂. The same research also shows that every European citizen consumes 26 kilos of clothes annually – three times as much as in 1975 – and throws away at least 11 kilos (European Environment Agency, 2021).

To refer to Italy, an IPSOS research for ING shows that 77% of respondents are in favor of environmental, economic, and social sustainability measures, even if these lead to slower growth. And if our country is one of the most sensitive in Europe, it is also true that attention to the environment is today an increasingly widespread heritage in the EU, with at least two out of three consumers who look at these values as a priority (IPSOS, 2019).

The textile sector is still a linear economic system, in which very little is reused and recycled. Of the 100 billion pieces produced every year in the world, less than 1% is recycled into new clothes. With almost all discarded clothes ending up in landfills or incineration plants (European Parliament, 2020).

Fast Fashion contributes directly to the environmental pollution caused by the textile industry, the second most polluting in the world, as well as among the first for energy and natural resources consumption. Trends change quickly and fast fashion responds to this logic: always new garments to support fashion.

From the dyes of fabrics, containing highly carcinogenic components for humans, to the raw materials used for the realization of clothing, mainly cotton and polyester, a highly toxic synthetic material derived from petroleum, therefore not biodegradable and not recyclable. These toxic substances in the fabrics are released from clothes with each wash, contaminating seas and oceans.

Research published in Nature Reviews Earth & Environment confirms the trend already noted in a 2018 study: with 4,000-5,000 million tons of CO₂ released annually into the atmosphere, the fashion industry as a whole (textiles, clothing, accessories, footwear and so on) is responsible for about 8-10% of global emissions; with 190,000 tons, it is guilty of the accumulation in the oceans of more than a third of microplastics. It contributes 20% to industrial water contamination worldwide and produces more than 92,000 tons of textile waste per year (including unsold clothing) (Niinimäki et al., 2020).

The fashion market was analyzed, in particular the leather goods sector, footwear and textile companies, identifying materials, processes and resulting products: this work is preparatory to a subsequent study concerning the Life Cycle Assessment in the textile sector.

From the study of the literature emerged several experimental solutions and good practices already used by some companies, among which there are also major fashion brands.

An example is the recycling of water after the dyeing process, to face the problem of pollution deriving from the processes of coloring the garments, developed by UTEXBEL (Gomez, 2017). Scientists have designed a test

recycling unit: two different processes are used to clean up the water. A first process, called electrocoagulation, eliminates dyes. A second, called reverse osmosis, contributes to the elimination of salts.

Other solutions derive from the development of natural dyes, obtained for example from bacterial pigments, as proposed by Colorifix, a Cambridge start-up that produces bacterial colonies capable of creating, with the least possible environmental impact, natural pigments (Lombardi, 2017).

Regarding the footwear sector, an alternative solution came by vegan shoes, which are a booming market, despite the fact that the footwear industry has always been linked to the use of animal-derived materials. There are not many companies that have decided to focus on cruelty-free references to follow market demands: the latest in order of time is the sportswear giant Reebok, which recently announced the creation of a new line of plant-based running shoes. The sneakers are called Forever Floatride GROW and are made by combining castor seeds, algae, natural rubber, and eucalyptus (Di Cintio, 2020).

The response from the leather sector has been slower, although it involves a large number of chemicals such as formaldehyde, cyanide and chromium in the tanning and dyeing process, which can be dangerous for both people and the environment.

An example of an ecological alternative in this sector is represented by the British pineapple materials company Anam, founded in 2013, was among the first to propose a plant-based leather alternative called Piñatex, the material uses fibres derived from pineapple leaves, which come from a plantation in the Philippines where they would otherwise be burned or left to rot (Mattioli, 2021).

These fibers are then mixed with polylactic acid (PLA), a bioplastic derived from corn, before being formed into a non-woven mesh, finished and coated to create a flexible yet durable material.

The fashion sector must strive to improve all possible ways of recovering the fabrics of discarded products, to drastically reduce the consumption of virgin matter. Therefore, it is important that fashion brands make their own contribution, first by originally studying the composition of the fabrics they use, to facilitate their subsequent reuse.

We need to replace the linear model with that of the circular economy, in which waste is limited, reused, and transformed from a problem into a resource. The new approach involves four key steps:

- use of non-polluting materials and not derived from plastic already at the beginning of the supply chain to avoid the previous pouring of microfibers into the oceans.
- focus on quality to extend the life of the garments, considering the way they are designed and marketed.
- support the theme of reuse and recycling.
- enhance a more efficient use of resources and renewable energy (Ellen MacArthur Foundation, 2017).

The circular economy is gaining increasing attention among entrepreneurs, producers, and government leaders, basically because the opportunities offered by this approach are manifold, among which can be found:

- economic growth.
- cost-saving production.
- greater innovation.

The potential benefits of moving to a circular economy extend to the concept of sustainability and environmental protection. This practice gives organizations large and small a path to reduce production costs, using fewer raw materials while meeting customer demands in new ways. By designing waste reduction, keeping products in use longer and regenerating materials, global climate goals can be achieved.

In conclusion, it can be said that the circular economy represents today the most sustainable model for companies in all sectors, in particular it is clear that this must be assumed by the fashion sector and that the transition to the circular model is not that hard but requires an important design phase.

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