


# Fibres, Textiles and Clothing: What are the Options in a Globalized Eco-Sustainable Economy?

ISSN: 2578-0271



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**Submission:**  January 17, 2024

**Published:**  January 25, 2024

Volume 9 - Issue 4

**How to cite this article:** Paul Kiekens\*. Fibres, Textiles and Clothing: What are the Options in a Globalized Eco-Sustainable Economy?. Trends Textile Eng Fashion Technol. 9(4). TTEFT. 000717. 2024. DOI: [10.31031/TTEFT.2024.09.000717](https://doi.org/10.31031/TTEFT.2024.09.000717)

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## Opinion

Actually, more than 100 billion (109) kgs of fibres are being produced (105 billion kgs in 2023) resulting in roughly 160 billion pieces of clothing. More than 70% of these fibres are man-made fibres (organic synthetic fibres and regenerated fibres) and almost 30% are natural fibres (conventional terrestrial fibres and aquatic fibres). A number of 8 billion people is consuming this enormous amount of fibre material in various forms.

These days there is a lot of environmental concern. A number of specific molecules are present in the atmosphere and are considered to be a real threat for all kinds of living species on our planet. Molecules such as CO<sub>2</sub>, methane, nitrogen (as nitrogen oxides, ...) and ammonia are disturbing our eco-system. Particularly CO<sub>2</sub> (and methane) contributes to the temperature rise of our planet and any removal during or after the production of materials is highly recommended. Since the beginning of the industrial revolution (18<sup>th</sup> century) a temperature increase of more than 1 °C is noticed. Contrary to what is calculated and estimated (Paris climate agreements, ...), the temperature rise will not be limited to 1.5 °C but without any doubt will increase to at least 2.5 °C or even more with disastrous consequences. This estimation is simply based on well-known laws of thermodynamics and a fact that so far nobody is mentioning or does not want to face up to: the world population will in a quarter of a century increase with 25% resulting in about 10 billion of people by the year 2050. This rise will proportionally result in extra amounts of materials and energy needed, leading to a surplus of harmful molecules mentioned before and fully responsible for the greenhouse effect. Such a scenario will have to be avoided in order to exclude the worst possible outcome: an (inhabitable) world or a system with a sequence of disasters and catastrophes as we have seen last year(s). The role of various sectors such as the materials industry in general, the chemical industry, the textile and clothing industry, the building and construction sector, tourism is obvious. New strategies are to be developed in all these sectors. The challenge is immense and also needs general acceptance by the public.

As far as the fibres, textiles and clothing industry is concerned, how can a (green) transition to a sustainable future be initiated ultimately resulting in a friendly ecosystem in which it is good to live? Automation plus digitalization contributing to efficiency and a mental switch are helpful but not enough. A complete change in the production chain of textile materials is the only solution!

Till recently cotton fibre was the dominant fibre for the production of textiles, with a share of about 25 %. The king of fibres however is not that "clean" in cultivation: pollution (pesticides, ...), use of water, soil degradation, etc. are key problems. Mechanical and particularly chemical finishing of the cotton fibres are other issues. Organic cotton (about 1% of the total cotton

production) is a hype but simply not an alternative. A lower and inconsistent quality, less yield, unpredictability and so on are typical for that kind of fibre. Alternatives such as hemp fibres, bamboo, ... are too small in amount to be meaningful. Regenerated fibres such as cellulosic fibres are subject of intensive research but still missing a real breakthrough as eco-friendly alternative. Much more research may lead to substantial progress and has to be intensified, thereby reducing the use of some specific chemicals in the production chain as one of the first targets.

Wool fibres do have some unique properties but are still not that important in percentage. In addition, turning raw wool material into textiles is a very demanding process including the use of large amounts of (toxic or hazardous) chemicals which makes wool fibres "problematic" to be seen as an eco-friendly fibre. Although being a quality fibre, also cashmere (the golden fibre) can be questioned particularly when the production of large amounts is strived for! Vast soil areas in Mongolia or China are being degraded by herds of cashmere goats (steppe → desertification).

A real point of interest is the polyester fibre. Over a period of about two decades this fibre has become the number one fibre in use covering more than 50% of the annual overall world fibre production. It is cheap, versatile with many nice characteristics and applied in a variety of textile products. However, this fibre has a few negative aspects. First of all, it is still for 99% based on petroleum, a fossil raw material. As oil definitely will be phased out in the decades to come (certainly completely by the end of this century for any application), an alternative raw material has to be found. Secondly and very problematic, is the generation of "microplastics" and even "nanoplastics". Actually 35% of microplastics in seas and oceans originates from textile products, the polyester fibre by far being the main source, in addition to polyamide fibres, acrylic and polypropylene in minor amounts. These types of plastics are of enormous environmental concern. The small particles are easily ingested by aquatic species and are thus entering the human food chain through consumption of seafood. It is estimated that per meal based on seafood, roughly 100 to 150 of these particles (micro and nano) are absorbed! Although data about the toxic effect on humans and distribution in the environment is still not fully understood, this particle phenomenon is a real challenge to be dealt with taking into account that growth in fibres will still be linked to synthetic fibres with high climate impact for a long time.

The production of textiles and all sorts of materials contributes to a world which needs something like a shock in order to fully understand and tackle the real challenge without any delay. Incremental improvements are far from enough. A sustainable transition will require a fundamental change. A circular economy must be put forward or become the basic goal. Consumption systems must be altered. Durable products that can be remade, repaired and / or recycled afterwards can enormously reduce

carbon, water and waste footprints. These days almost half of the fibres for textiles do become waste and a (very) small percentage of that waste is recycled or can be recycled!

A new entrepreneurial mindset has to be developed. Linear business models have to be left behind. Circularity is the way to go, guaranteeing a low(er) environmental impact including saving large amounts of energy. Durable textile products must be the target in addition to green design with a careful selection of raw materials from the very beginning. The focus should be on manufacturing of higher quality (textile) products leading to longevity and durability. Fast or super-fast fashion driven by countries like China, Bangladesh, India and others do result in mountains of dumped (extremely) low quality goods or clothes on the African continent and in South America.

Better initial design processes have to be adopted guaranteeing less use of toxic chemicals (urea, formaldehyde, ...) in the production chain. One should aim at the use of less virgin raw materials indicating the effective need for recycling, maximize the use (renaissance) of natural (polymer) fibres of plant or animal origin, go for biodegradable raw materials particularly as they make only 2% now, and so on. Durable textile products are the target to master the environmental impact via a holistic approach. The ideas of reducing, repair, reuse, recycle, ... have to be adopted.

Eco-design is the challenge and must become the basic attitude. Mass consumption relying on cheap labour causes pollution and waste, and that waste is mostly unsuitable for recycling. Textile products have to become physically and emotionally durable.

Green design is the way to go. Without any doubt this goal will be achieved by creativity and so by lots of research, also meaning a very high cost! Much more adequate research has to be looked at. How can research be optimized? Academic research, or blue-sky research, is often too much focused on just getting results on paper. Industrial or applied research is going for a quick win. One has to come to a compromise based on an intelligent combination of the various kinds of research in order to avoid a research deficit meaning spending lots of money with a lack of eco-results. The need is high. So, research must pay off, has to be successful. It means that any research and so the money related has to be well justified, particularly by showing quite clearly what are the benefits for society and what are the indisputable results afterwards. This approach will help the fibre, textile, and clothing industry to make the transition towards a low-emission world urgently needed. By doing so, a kind of catastrophe like annihilation of living matters on earth can be prevented.

Not to forget that this challenge is valid for other (or all) sectors! But let us stay optimistic as we can manage this giant assignment via a joint and intelligent approach as what happened with Covid-19, even if it may be at a galactic cost!