Unit 1.3 Circular Economy in Textile Sector

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1.3.1 Definition and principles of Circular Economy

What does mean Circular Economy ?

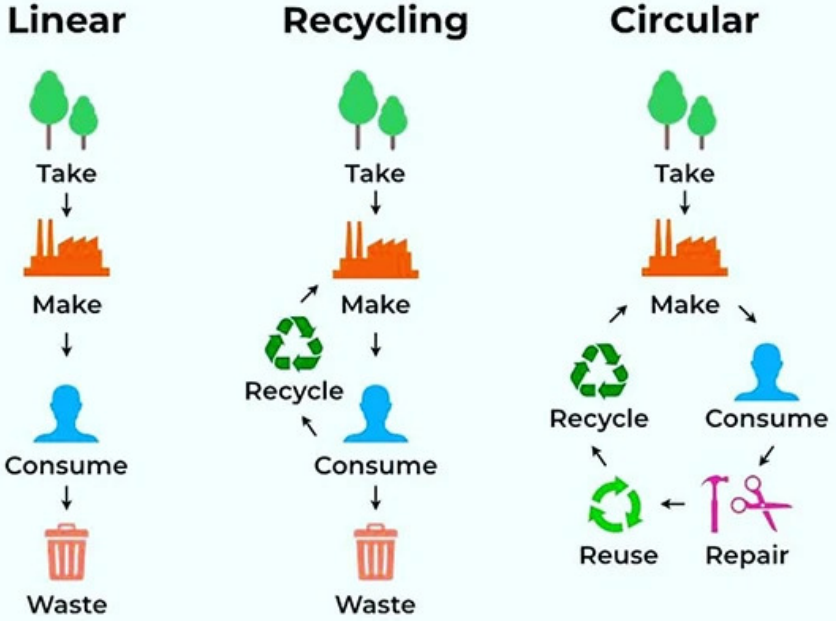
The Ellen Mc Artur foundation presents the most common definition of Circular Economy (CE):

"An industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models"[1]

The transition towards a circular economy, according to the European Commission, is: **"the opportunity to transform our economy and to generate new and sustainable competitor advantages for Europe"**

Source: Pixabay[2]

From linear to a circular economy



Source[3]

The circular system and the linear system differ from each other in the way in which value is created or maintained. A linear economy traditionally follows the **"take-make-consume-dispose"** step-by-step plan. This means that raw materials are collected, then transformed into products that are used until they are finally discarded as waste.

A circular economy follows the **3R** approach: **reduce, reuse and recycle.** Resource use is minimized (reduce). Reuse of products and parts is maximized (reuse). And last but not least, raw materials are reused (recycled) to an high standard.

Principles of circular economy

Three core principles govern the circular economy:

Figure 1. Principles associated with the transition to a circular economy according to the Ellen MacArthur Foundation [4]

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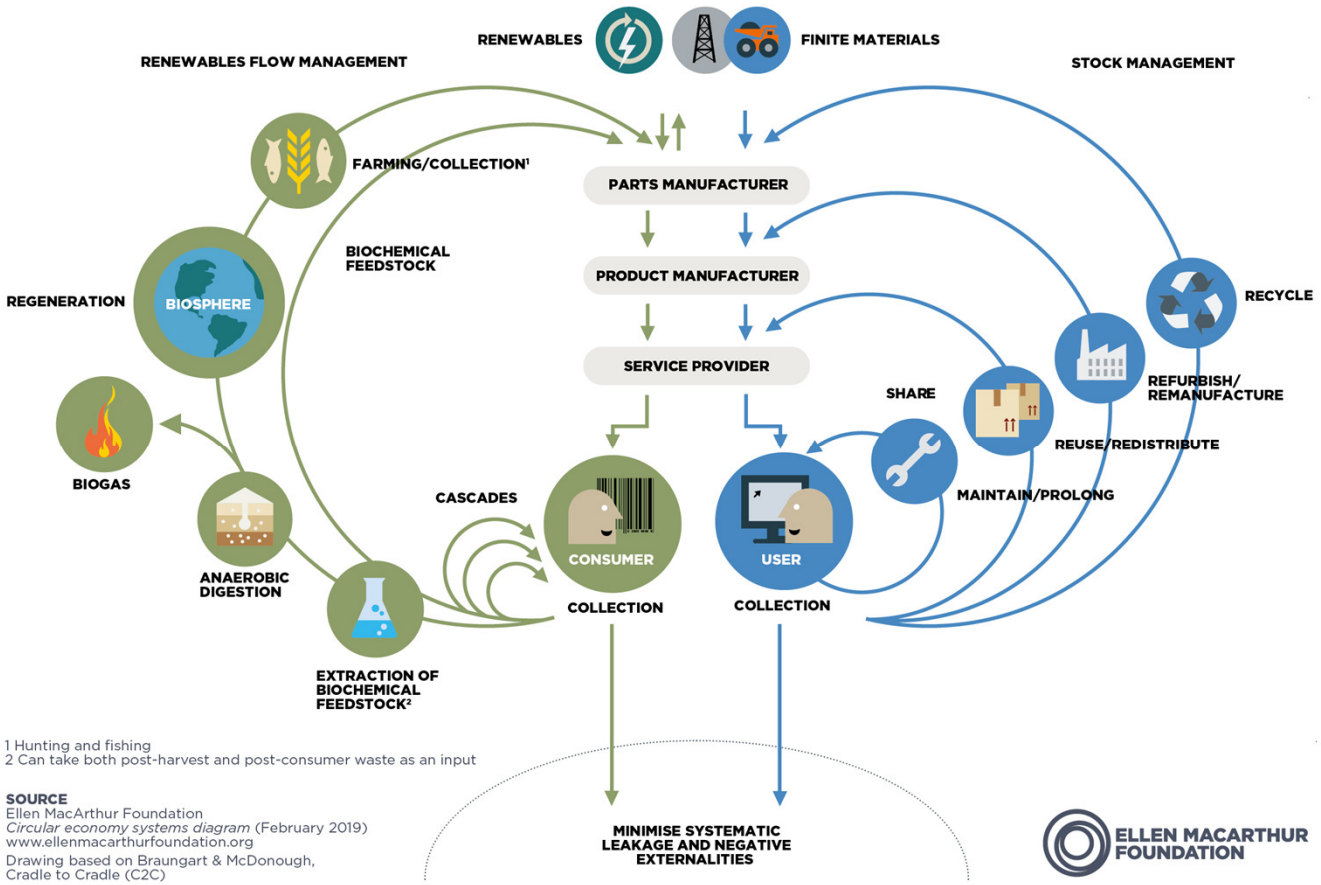


Figure 2. Circular Economy butterfly diagram [5]

A circular economy (Fig.2), is characterised by a value chain that extends over the entire product life cycle and also includes the so-called reverse value chain which creates value by reintegrating used products and materials into the economic cycle.

1.3.2 Current situation on textile industry: environmental, climate and social impact

Current clothing system

The current system for producing, distributing, and using clothing operates in an almost completely linear way. Large amounts of non-renewable resources are extracted to produce clothes that are often used for only a short period, after which the materials are largely lost to landfill or incineration. It is estimated that more than half of fast fashion produced is disposed of in under a year.

Figure 3. Global material flows for clothing in 2015 [6]

Environmental and climate impacts

- Resource use
- Solid waste (packaging and textile)
- High use and dispersion of toxic substances
- High volume of water consumption
- Microfibres in the ocean
- Greenhouses gas (GHG) emissions
- Intensive land use and biodiversity loss

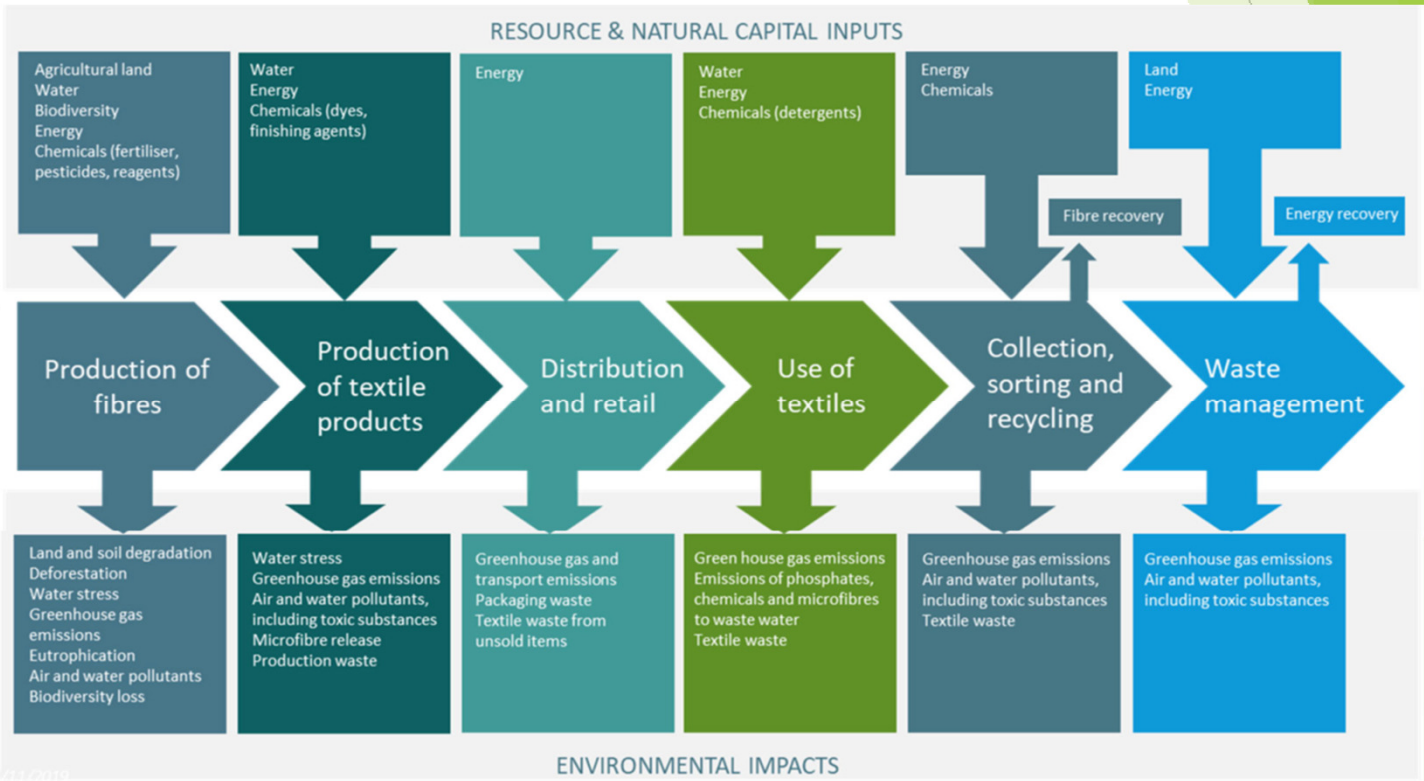


Figure 4. Environmental impact across the textile life-cycle[7]

Environmental and climate impacts

Resource use

The textiles industry relies mostly on non-renewable resources – 98 million tonnes in total per year – including oil to produce synthetic fibres, chemicals for dyeing and processing and pesticides and fertilizers for growing cotton.

Table 2. Consumption of non renewable resource per year[5]

Non-renewable resources	Quantity per year
Barrel of oil for the production of plastic based fibres	342 million barrels
Pesticides for the production of cotton	200000 tonnes
Fertilizers	8 million tonnes
Chemicals used for the production of fibres and textiles	43 million tonnes

Environmental and climate impacts

Water consumption

- Fashion industry currently uses around 93 billion cubic metres of water per year, which is 4% of all freshwater extraction globally. On current trends, this amount is set to double by 2030.
- Value chain stages that are significant consumers of water are: raw material production, beaching, dyeing in textile production and use (laundering)[9]
- High use in fibre production is due to the high levels of water required in growing cotton, many of the key cotton producing countries are under high water stress including China , India, the US, Pakistan and Turkey
- It's estimated that processing (including spinning, dyeing, finishing) a kilogram of fibre (not just cotton, but also polyester and other materials) requires 100 to 150 litres of water.
- Washing clothing using washing machines is estimated to require an additional 20 billion cubic metres of water per year globally.

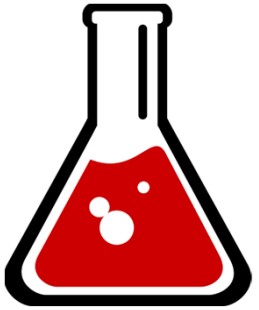
Source[8]

Source: Pixabay[2]

Environmental and climate impacts

Chemicals

- Significant volumes of chemicals are used to produce clothing and other textiles: it is estimated that between 1.5 and 6.9 kg of chemicals are used in the production of 1 kg of garments[10]
- While most substances used in textile production and found in finished products are safe, some are substances of concern causing health and environmental impact
- About 3,500 substances used in textile production have been identified, of which 750 are classified as hazardous to human health and 440 to the environment[11]
- It is estimated that about 20 per cent of global water pollution is caused by textile dyeing and finishing



Source: Pixabay[2]

Source[12]

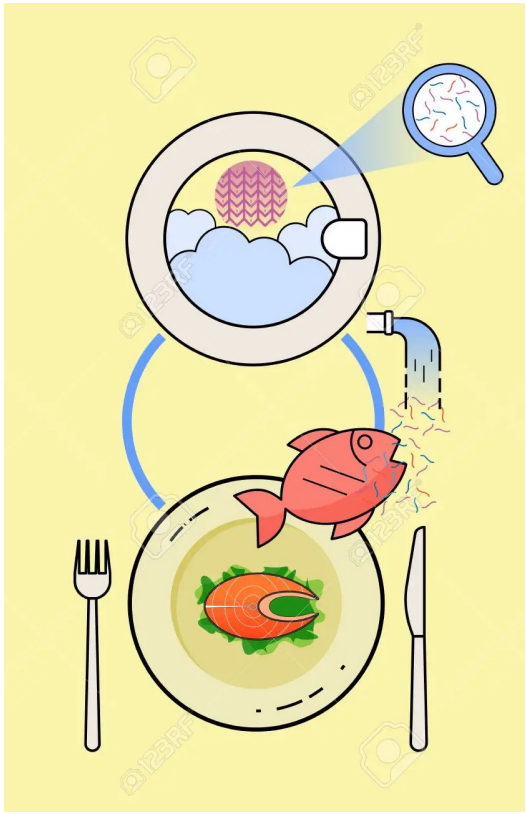
Environmental and climate impacts

Microfibres in the oceans

- Synthetic laundry accounts for 35% of the primary microplastics released into the environment: a single load of polyester clothing can shed 700,000 microplastic fibres that can find their way into the food chain

- Ingestion of microplastics has been demonstrated to cause starvation and stunted growth in some species, and to have the ability to release substances of concern by breaking down in the digestive system

- One study estimates that an average European shellfish consumer eats as many as 11,000 microplastic particles per year through their diet[5]



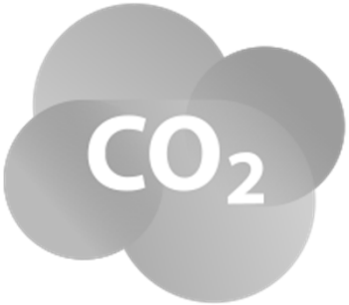
Source[13]

Environmental and climate impacts related to the textile system

Greenhouses gas (GHG) emissions

- The fashion industry was responsible for 2.1 billion metric tons of GHG emissions in 2018, about 4% of the global total, making a sizeable contribution to climate change[14]

- Emissions are produced at all stages of a garment's lifetime; from sourcing the raw materials to its laundry and disposal. However, 70% of the fashion industry's emissions come from the production process, during fibre production and clothing manufacture[15]



Environmental and climate impacts

Land use

- Land use is one of the main drivers of loss of biodiversity worldwide
- Land use associated with global apparel is strongly weighted towards the fibre production stage
- The contribution to land use of the other value chain stages is indirect, in that it relates to the land associated with producing the energy used in manufacturing and laundering textiles.

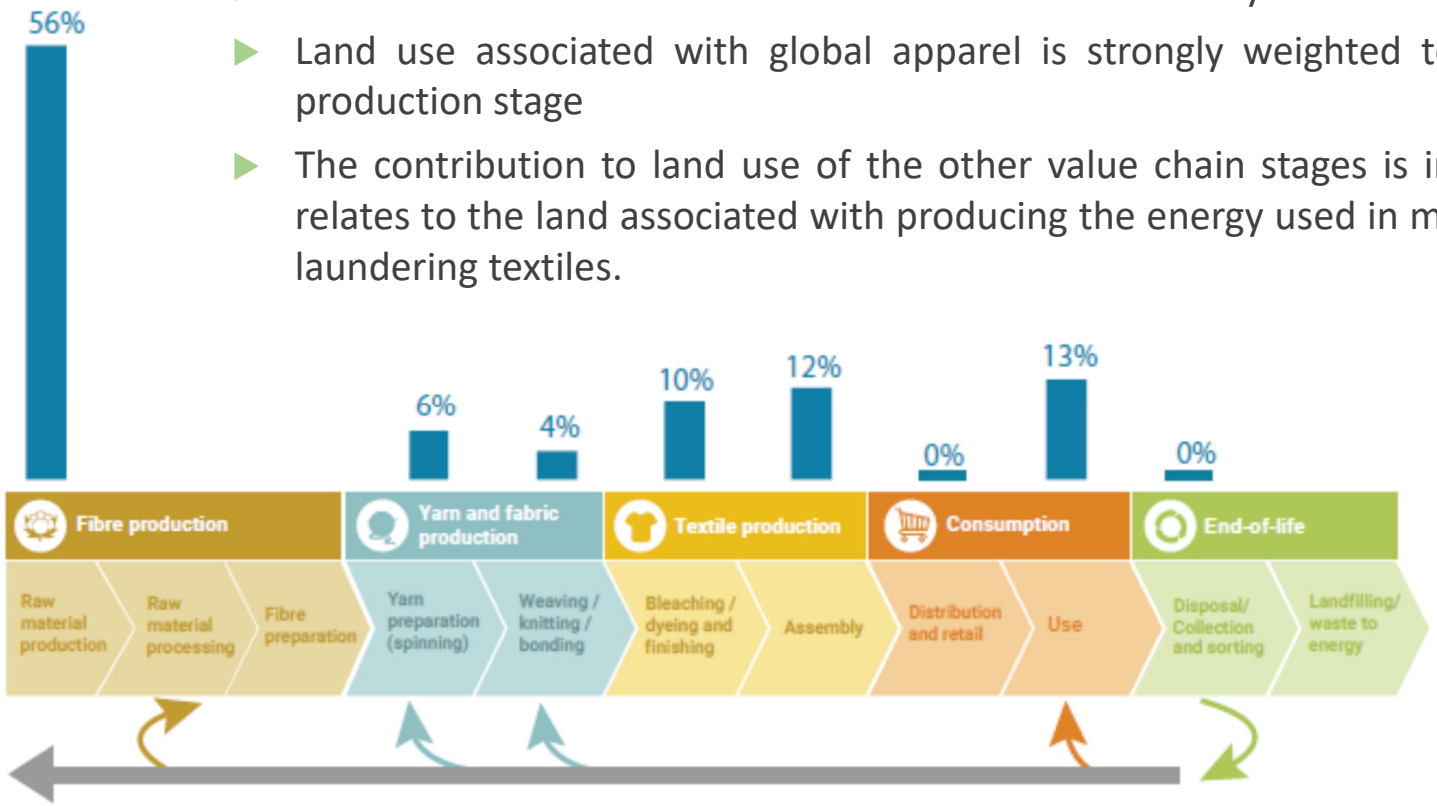


Figure 5. Land use impact across the global apparel value chain[9]

Socio-economic impacts

Damage to human health

Dangerous working environments due the unsafe processes and hazardous substance used in production, in particular women are disproportionately affected by these health impacts since they make up the majority of the textile workforce[9]

Source[16]

Social risks

Poor working conditions, including excessive working hours, low wages and forced labour

1.3.3 Transition to a circular fashion system

Fast fashion

- It's a linear economy system, which motivates the customers to buy more clothes because they are affordable but discard these after only one season.[17]

- The fundamental concept behind the fast fashion strategy is consumption, fast-changing trends, and low quality, which leads the consumers to change their preference more frequently. Globally each year, millions of garments end up in a landfill.

Source[18]

Definition and principle of circular fashion

"Circular fashion can be defined as clothes, shoes or accessories that are designed, sourced, produced and provided with the intention to be used and circulate responsibly and effectively in society for as long as possible in their most valuable form, and hereafter return safely to the biosphere when no longer of human use"[17]

Green Strategy, an innovation-driven and research-based consultancy firm specializing in sustainability and circularity issues of the fashion industry, has identified sixteen key principles to support a more circular and sustainable fashion and textile industry

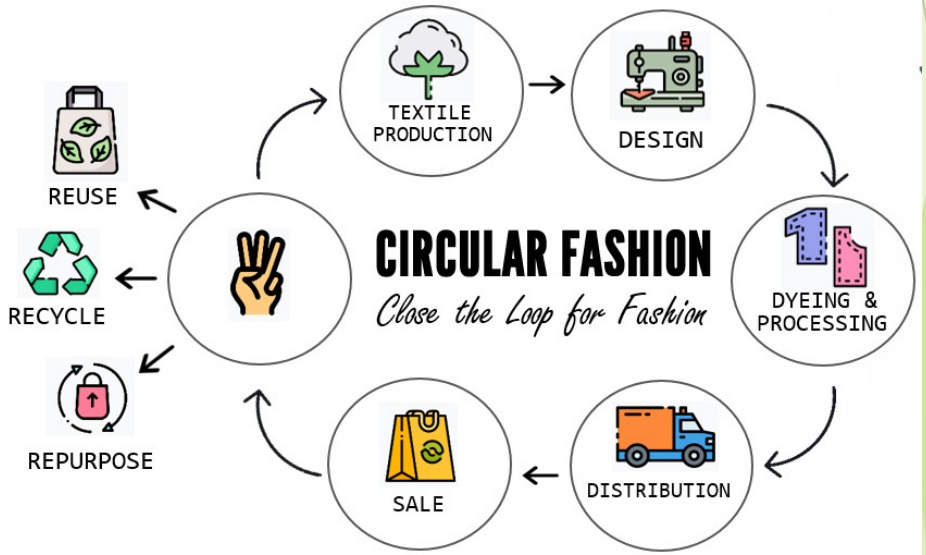


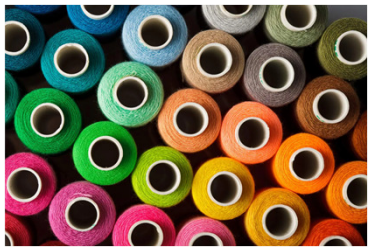
Table 3. Sixteen principles of circular fashion[X]

Design phase		Source and manufacture	
Principle 1	Design with a purpose	Principle 6	Source and produce more locally
Principle 2	Design for longevity	Principle 7	Source and produce without toxicity
Principle 3	Design for resource efficiency	Principle 8	Source and produce with efficiency
Principle 4	Design for biodegradability	Principle 8	Source and produce with renewables
Principle 5	Design for recyclability	Principle 10	Source and produce with good ethics
Service		**User phase**	
Principle 11	Provide services to support long life	Principle 14	Use, wash and repair with care
Principle 12	Reuse, recycle or compost all remains	Principle 15	Consider rent, loan, swap, secondhand or redesign instead of buying new
Principle 13	Collaborate well and widely	Principle 16	Buy quality as opposed to quantity

1.3.4 Application of circular system in textile supply chain: challenges, measures, benefits and barriers

Goals and challenges

- Input for textile are safe, recycled or renewable



- Textiles are kept use for longer

- Textiles are recyclable and recycled at end of use[19]

Measures

The transition towards a circular textile sector requires several changes from current practices, while still ensuring an offer of high-quality, affordable products.

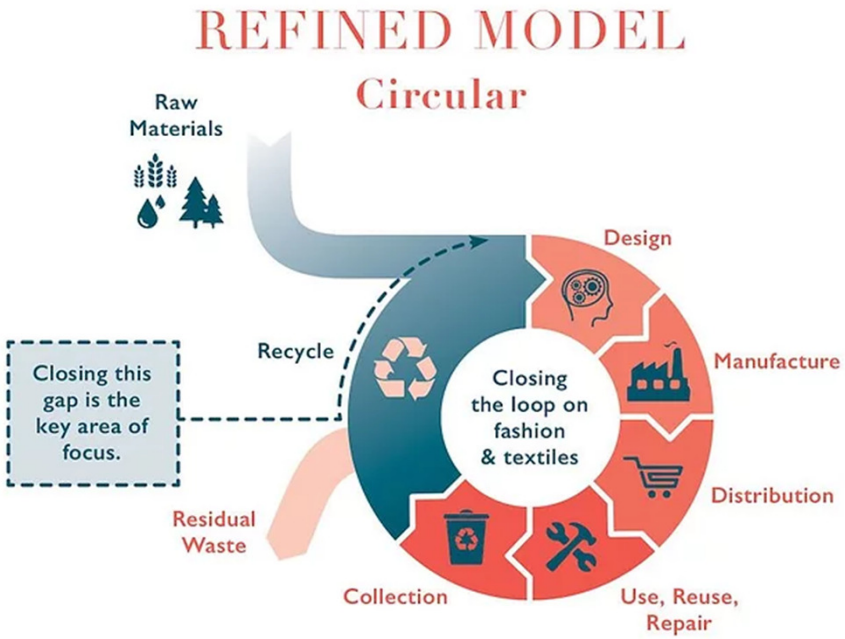


Figure 6. A simplified model of fashion system with focus on moving to "closing the loop" at the end of product usable life.[20]

Measures

Circular design:

- Designed so that its components can be separated to facilitate their disassembly or repair and to facilitate the action of reassembling, reusing and eventually recycling the material at the end of its useful life.

- Designed with quality materials and with a timeless style to maximize its durability, longevity and attractiveness for many users (depending on whether during its useful life it goes from one user to another, and to new users).

- Designed on demand, custom-made, to be created in a more efficient way for its specific user in terms of fabric, material, style and fit, thus increasing its perceived value and likely useful life[21]

Measures

Circular production:

- Produced with non-toxic, high quality and preferably biodegradable materials, so that their components can be safely biodegraded and composted at the end of use; or produced with non-toxic synthetic materials that can be effectively recycled.

- Produced in such a way that all waste generation is minimized during the manufacturing process in the textile factory and all left over material in the cutting, tailoring, dyeing and finishing processes can be recovered and reused as raw material for other processes and other articles, thus minimizing the extraction and use of new virgin raw material.

- Produced, transported and marketed using renewable energy such as wind or solar whenever possible and using water and other resources efficiently and safely during production and distribution

Measures

Circular use, collection, reuse and recycling:

- It can be used by multiple users throughout its useful life through exchange, loan, rental, redesign or second-hand services, thus extending its useful life;
- It can be recovered and recycled safely and effectively, so its components are used as raw material for the manufacture of new products or are biodegraded and converted into biological nutrients for microorganisms in the soil
- Better collection, sorting and management of textile waste to ensuring more reuse and recycling and preventing waste to being incinerated or landfilled

Benefits

Environment
Lower GHG emission
Reduced consumption of virgin , non renewable materials and of energy
No leakage of hazardous substances into the environment

Society
Positive health impact
Improved working conditions
Increase in quantity of employment

Economy
Increase of productivity
Creation of innovation

Barriers

- Sustainability is not consumers' most important purchasing decision driver.
- Lack of support from governments to create openness, guide efforts, and reduce costs, to implement more ecological solutions.
- Due to globalization and many partners in the fashion industry, it is more difficult to create a completely circular/sustainable chain.
- Difficulties range from technical challenges, such as separating fabric mixtures, to high costs for recycling.
- Low maturity of scalable high–quality recycling technology[19,22]

1.3.4 Initiatives and platforms towards Circular Economy in textile

Initiatives advancing circularity in textiles

- **Platform for Accelerating the Circular Economy (PACE)**:

It's intended to accelerate the transition to a circular economy by supporting and scaling up public – private partnerships and providing connections, learning and opportunities to pilot and scale best practices. PACE work is articulated around thematic areas, including one on Textile and Fashion[23]

- **Make Fashion Circular - Ellen Mac Arthur Foundation:**

An initiative bringing together leaders from across the fashion industry, including brands, cities, philanthropists, NGOs, and innovators with the aim to stimulate the level of collaboration and innovation necessary to create a new textiles economy, aligned with the principles of the circular economy[24]

1.3.4 Initiatives and platforms towards Circular Economy in textile

Platforms addressing sustainability in textile production

- **Alliance for Sustainable Fashion:**

initiative of United Nations agencies and allied organizations that works to support coordination between UN bodies working in fashion and promoting projects and policies that ensure that the fashion value chain contributes to the achievement of the Sustainable Development Goals' targets[25]

- **European Clothing Action Plan (ECAP):**

project supported by EU LIFE funding with the goal to bring circularity and sustainable approach to fashion and textile in Europe[26]

- **Global Fashion agenda:**

Leadership forum and advocacy for industry collaboration on sustainability in fashion[27]

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