Introduction to Sustainability

Chapter Outline

- Sustainability
- Necessity of Sustainability
- Few Terms Regarding Sustainability
- The Textile Industry and Sustainability
- Environment Impacts and its Challenges

Sustainability is the practice of meeting present needs without compromising the ability of future generations to meet their own needs, by balancing environmental, social, and economic concerns.

Sustainability

Sustainability is an all-inclusive concept that contains the ongoing balance of economic, social, and environmental factors in human society. It influences all levels of organization, from the local neighborhood to the entire planet. In principle, sustainability is our responsibility to act in ways that will sustain life and allow the next generations to live comfortably in a friendly, clean, and healthy world.

Sustainability is based on a simple principle: everything we need for our survival and well-being depends directly or indirectly on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony that permits fulfilling the social, economic, and other requirements of present and future generations. Sustainability is vital to ensure that we have and will continue to have the water, materials, and resources to protect human health and our environment.

Necessity of Sustainability in Textile (2019)

Background:

The Textile industry has historically been one of the largest industrial sectors, contributing significantly to global economic growth.

However, it is also one of the most resource-intensive and polluting industries, using large quantities of **water, energy, chemicals, and raw materials.**

The pressing concerns about **climate change, environmental degradation, and resource reduction** have led to a growing focus on sustainability in Textiles over the past few decades.

The necessity of Sustainability in Textiles can be explained below:

Several critical factors drive the necessity of sustainability in the textile industry:

Environmental Protection: The textile industry is a major contributor to pollution, waste, and resource depletion. Sustainable practices are essential to reduce the environmental impact, including water usage, chemical pollution, and carbon emissions. Protecting ecosystems and biodiversity is crucial for the health of the planet.

Resource Conservation: Sustainable textiles promote the efficient use of natural resources. As water scarcity and energy shortages become increasingly pressing issues, it's vital to implement practices that minimize resource consumption and promote the use of renewable materials.

Climate Change Mitigation: The textile industry significantly contributes to greenhouse gas emissions. Transitioning to sustainable practices can help reduce the industry's carbon footprint, supporting global efforts to combat climate change and its associated impacts.

Social Responsibility: Sustainable practices address labor rights and social equity issues within the industry. Ensuring **fair wages, safe working conditions, and respect for workers' right**s is essential for building a just and ethical supply chain.

Consumer Demand: There is a growing demand from consumers for eco-friendly and ethically produced textiles. Brands that adopt sustainable practices can enhance their market competitiveness and appeal to environmentally conscious consumers.

Regulatory Compliance: Governments and organizations are increasingly implementing regulations and standards aimed at reducing the environmental and social impacts of textile production. Adopting sustainable practices can help companies stay compliant with these regulations and avoid potential legal issues.

Economic Viability: Sustainable practices can lead to long-term cost savings through improved efficiency and waste reduction. Investing in sustainable technologies can enhance profitability and reduce operational risks associated with resource scarcity and environmental impact.

Innovation and Competitive Advantage: Embracing sustainability encourages innovation in materials, processes, and business models.

Companies that prioritize sustainability can differentiate themselves in the market and attract consumers looking for responsible choices.

Circular Economy Transition: Sustainability in Textiles aligns with the principles of a **circular economy**, promoting the reuse, recycling, and upcycling of materials. This approach minimizes waste and extends the lifecycle of products, contributing to a more sustainable future.

Global Responsibility: As a global industry, the textile sector has a responsibility to contribute positively to social and environmental issues. Sustainable practices can help address global challenges such as poverty, inequality, and climate change, developing a more equitable world.

Shortly, the necessity of sustainability in Textiles is pointed out:

- To maximize efficiency in using raw materials, energy, and water.
- To reduce continuous waste and optimal utilization of unavoidable waste,
- To reduce greenhouse gas emissions, global warming, and carbon footprint.
- To protect environmental, health, and social safety issues.
- Being innovative and developing products and applications with an enhanced sustainability profile,
- To respect and go beyond high work safety standards and social conduct.
- To control cost and quality for survival in the competing global market.
- To save the entire ecosystem.

IMPORTANT

Green Textiles (2021)

Green Textiles refer to Fabrics and Textile products that are produced, processed, and used in ways that minimize their environmental impact, while also being socially responsible and economically viable.

The goal of green textiles is to ensure that the materials, manufacturing processes, and the lifecycle of the textile products align with sustainability principles, as represented in the diagram you shared—where social, environmental, and economic considerations overlap.

Key Principles of Green and Sustainable Textile (2021)

1. **Raw Materials Selection**: Green textiles often use organic, natural, or recycled fibers instead of synthetic fibers derived from petrochemicals. Organic fibers are grown without the use of synthetic pesticides or fertilizers, reducing the impact on soil and water resources.
2. **Low Environmental Impact Processing**: Sustainable textile production processes aim to minimize water and energy consumption and release pollutants and harmful chemicals. This might involve technologies that use less water, energy-efficient machinery, and closed-loop systems for dyeing and finishing.
3. **Reduced Chemical Usage**: Toxic chemicals commonly used in conventional textile production, such as certain dyes, bleaches, and finishing agents, can harm both the environment and workers. Green textiles prioritize the use of non-toxic and low-impact alternatives.

4. **Fair Labor Practices**: Green textiles also consider the ethical treatment of workers throughout the supply chain, ensuring fair wages, safe working conditions, and adherence to labor rights.

Fundamental Principles of Green and Sustainable Textile:

Eco-friendly Raw Materials: Use of organic, recycled, or biodegradable fibers.

Low Resource Consumption: Minimizing water, energy, and chemicals in production.

Waste Reduction: Promoting recycling, upcycling, and zero-waste design.

Non-toxic Processing: Avoiding harmful dyes and finishes.

Social Responsibility: Ensuring fair labor and safe working conditions.

Lifecycle Thinking: Designing products for durability, reuse, and recyclability.

5. **Biodegradability and End-of-Life**: Green textiles are designed with a focus on their eventual disposal. Ideally, these textiles are biodegradable or can be easily recycled into new materials, reducing the burden on landfills.
6. **Reduced Carbon Footprint**: Sustainable textiles aim to reduce greenhouse gas emissions throughout the entire lifecycle, including production, transportation, and disposal.
7. **Certifications and Standards**: Various organizations provide certifications for textiles that meet specific eco-friendly criteria. Examples include Global Organic Textile Standard (GOTS), OEKO-TEX Standard 100, and the Cradle to Cradle Certified Product Standard.

Principle of Green Chemistry

There are twelve principles:

1. Use renewable feedstock.
2. Use safe or non-toxic but fully effective products.
3. Use secure chemical synthesis methods.
4. Adopt catalytic reactions to minimize waste. Gold is an excellent catalyst for oxidation processes.
5. Use energy-efficient processes - prefer ambient temperature and pressure reactions.
6. Use safer solvents and auxiliaries - use aqueous or safe media.
7. Omit sequential chemical steps - choose direct reactions.
8. Follow the atom economy: There should be few wasted atoms.
9. Prevent waste - eliminate/minimize waste treatment processes.
10. Use chemical products that are easily degradable to harmless substances.
11. Real-time analysis - Minimize/eliminate by-products by real-time monitoring and control.
12. Safety - Ensure minimum chemical accidents (e.g., explosions, fires, and harmful releases).

Few Terms Regarding Sustainability

Sustainable Textiles (2021)

Sustainable textiles refer to fabrics and materials that are produced, used, and disposed of in ways that minimize negative environmental and social impacts. The goal of sustainable textiles is to reduce the consumption of natural resources, limit pollution and waste, promote ethical labor practices, and support a circular economy. These textiles are designed to be environmentally friendly and socially responsible throughout their entire life cycle—from raw material sourcing to production, use, and disposal.

Examples of Sustainable Textile Materials:

- **Organic Cotton**: Grown without synthetic chemicals, pesticides, or genetically modified organisms (GMOs), reducing the environmental impact on soil and water.
- **Hemp**: A fast-growing plant that requires fewer resources, such as water and pesticides, compared to cotton.
- **Bamboo**: Often used for textiles due to its rapid growth and minimal resource needs, though the processing method must also be sustainable.
- **Recycled Polyester**: Made from recycled plastic bottles or discarded polyester garments, reducing the need for virgin petroleum-based fibers.
- **Tencel/Lyocell**: A fiber made from sustainably harvested wood pulp, processed with non-toxic solvents in a closed-loop system.

The Requirements of Sustainable Textiles involves:

- All materials, process inputs, and outputs are safe for human and ecological health in all product life cycle phases.
- All energy, material, and process inputs come from renewable or recycled sources.
- All materials can return safely to either natural or industrial systems.
- All stages in the product life cycle actively support the reuse or recycling of these materials at the highest possible level of quality.
- All product life cycle stages enhance social well-being.

Sustainable Fashion

Sustainable fashion/Eco-fashion is an all-inclusive term describing products, processes, activities, and policymakers, brands, and consumers aiming to achieve a carbon-neutral fashion industry built on equality, social justice, animal welfare, and ecological integrity.

Sustainable fashion addresses the entire process in which clothing is produced, consumed, and disposed of; who, what, how, when, where and the expected useful life of the product before entering the landfill.

The sustainable movement looks to combat the large carbon footprint that fast fashion has created by reducing the environmental impact of fashion, such as air pollution, water pollution, and overall climate change.

Sustainable Clothing (2019)

Sustainable clothing refers to fabrics produced from eco-friendly resources, such as sustainably grown fiber crops or recycled materials.

- It also refers to how these fabrics are made.
- Historically, being environmentally conscious towards clothing meant (1) buying clothes from thrift stores or any shops that sell second-hand clothing or (2) donating used clothes to shops previously mentioned for reuse or resale.
- In modern times, with a prominent trend toward sustainability and being 'green,' **sustainable clothing has expanded towards (1) reducing the amount of clothing discarded in landfills and (2) decreasing the environmental impact of agrochemicals in producing conventional fiber crops (e.g., cotton).**

Sustainable Development (SD) (2022)

Sustainable Development (SD) is the concept of meeting the needs of the present without compromising the ability of future generations to meet their own needs. It seeks to balance economic growth, social well-being, and environmental protection, ensuring that development is inclusive and environmentally sound.

The core idea of SD is to integrate economic, social, and environmental goals to achieve long-term prosperity and well-being for both current and future generations. It encourages responsible use of resources, reduction of

inequalities, and preservation of ecosystems to ensure that humanity can continue to thrive without depleting the earth's finite resources.

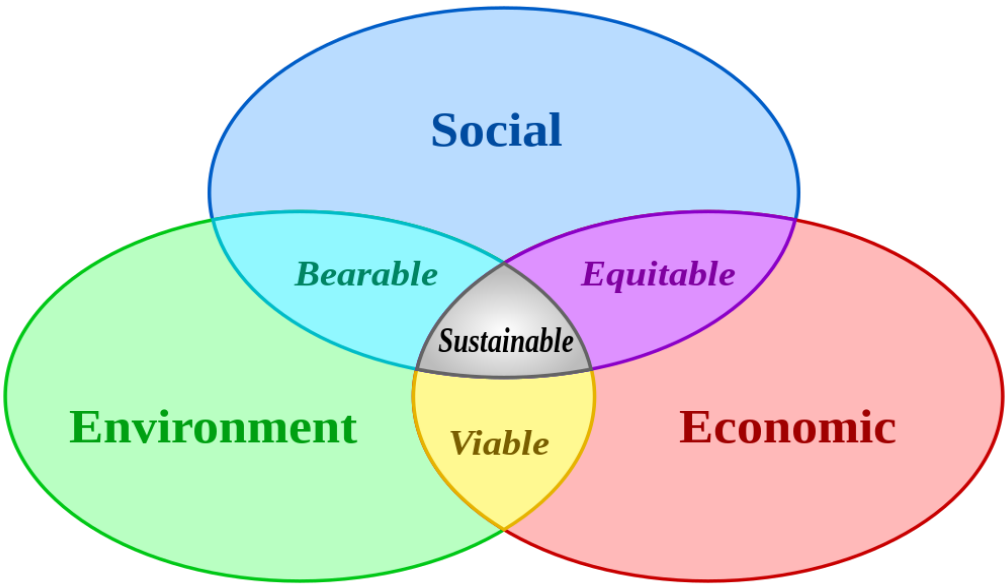
Sustainable Development is often aligned with the 17 Sustainable Development Goals (SDGs) established by the United Nations, which address global challenges such as poverty, inequality, climate change, environmental degradation, and peace and justice.

Sustainable Development consists of three core components, often referred to as the three pillars:

1. **Economic Sustainability**: This involves promoting economic growth and development while ensuring efficient use of resources, reducing inequality, and maintaining long-term economic health. It focuses on creating systems that are financially viable and equitable over the long term.

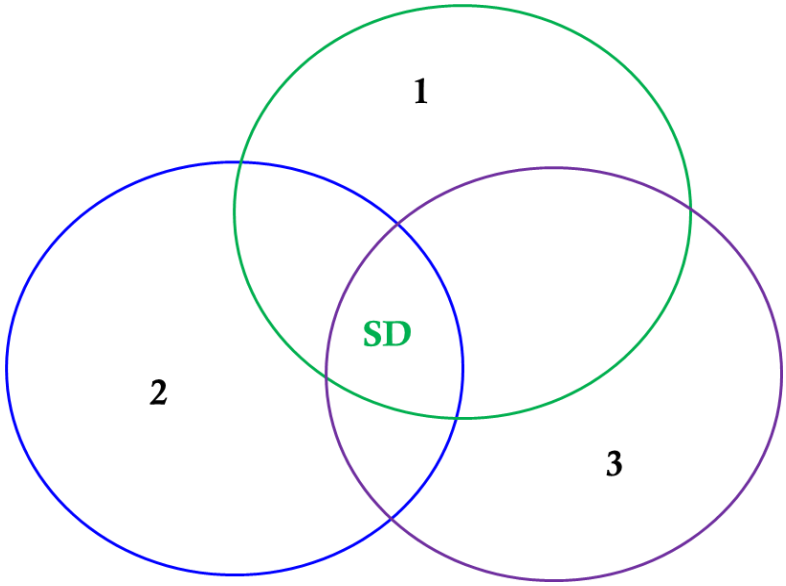
2. **Social Sustainability**: This pillar emphasizes human well-being, equity, and social inclusion. It aims to meet basic needs such as health, education, and social justice, fostering cohesive communities that can adapt and thrive over time.

3. **Environmental Sustainability**: This involves protecting ecosystems and natural resources to ensure long-term ecological balance. It focuses on minimizing environmental degradation, reducing pollution, and promoting practices that conserve biodiversity and mitigate climate change.



Principle of SD

1. Improving the quality of human life.
2. Economic growth for all (For rich and poor).
3. Environmental Development.



Objectives of Sustainable Development (2022)

i. To protect our biodiversity.
ii. To increase forest cover, maintaining natural and environmental balance.
iii. To prevent environmental pollution.
iv. To reduce waste.
v. Design eco-friendly technology that creates less pollution and promotes sustainable development.
vi. To control population growth.

Sustainable Production IMPORTANT

Sustainable production is the creation of goods and services using processes and systems: non-polluting, conserving energy and natural resources; economically efficient, safe, and healthful for workers, communities, and consumers; socially and creatively rewarding for all working people.

The Textile industry and sustainability

The textile industry is one of the most extended and complex industrial chains of the manufacturing industry. **It involves actors from agriculture, chemical fibers, dyes, and chemical manufacturing, the textile and apparel industry, the retail and service sector, and waste treatment**.

Most textile production processes, such as sizing, scouring, washing, bleaching, dyeing, and finishing, consume large volumes of fresh water and discharge large volumes of effluent, generally with intense color, high concentration of organic compounds, and significant variations in composition.

A detailed flow chart showing the key operations and players in the textiles industrial chain is depicted in Figure 2.

Inputs marked in Figure 2 as

- **Number 1 refers to raw materials, energy, water, chemicals, auxiliaries, and even human inputs (labor).**

Outputs marked in Figure 2 as

- **Number 2 refers to finished products, emissions (to air, water, and land), wastewater, and solid waste**.

As indicated in Figure 2, finished products reach the consumer after-sales efforts. After the consumer uses and decides to dispose of them, they might join the same supply chain back as inputs if the product is recycled (as a closed loop).

The key operations include in Textiles and Clothing industrial chain (2022)

- Fiber cultivation or manufacturing;
- Textile and clothing production;

- Retailing;
- Consumer use;
- End of life.

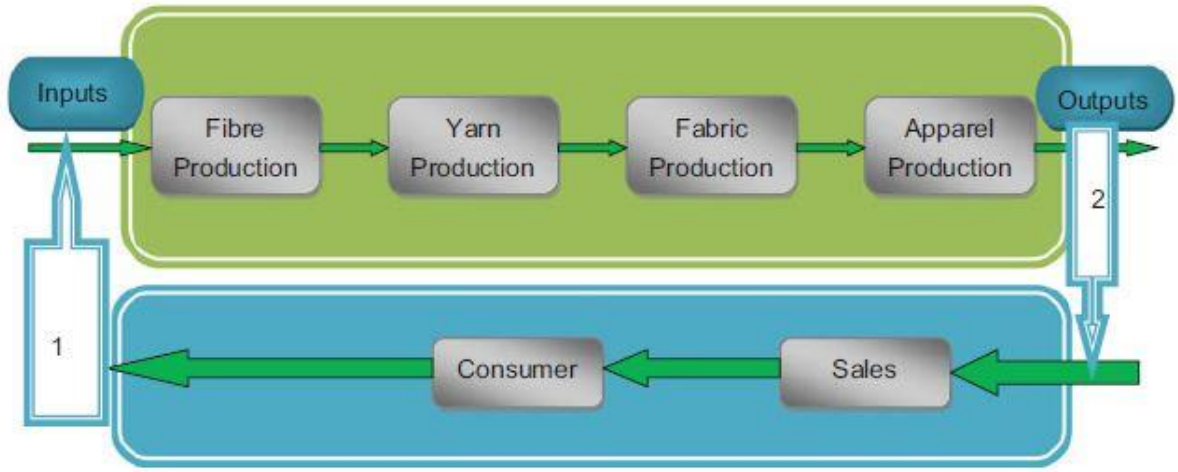


Figure 2: Textiles and clothing industrial chain

- 1 refers to raw materials, energy, water, chemicals, auxiliaries, and even human inputs (labor).
- Number 2 refers to finished products, emissions (to air, water, and land), wastewater, and solid waste.

Environmental Impacts due to various Textile products in their different **Life Cycle** phases are summarized below.

- Climate change or Carbon Footprint;
- Ecological Footprint;
- Acidification;
- Eutrophication;
- Human toxicity;
- Eco-toxicity;

- Water reduction;
- Energy demand;
- Depletion of abiotic and biotic resources;
- Ozone depletion potential;
- Photochemical smog;
- Land use impacts.

The Challenges in the View of Environmental Impacts (2021)

The main environmental impacts challenging the current textile industry are as follows:

- Significant energy use in the entire manufacturing link.
- Climate Change or Carbon Footprint in the whole manufacturing link.
- Ecological Footprint.
- Significant water use in fiber manufacturing and production stages.
- Eco-toxicity from washing and drying of textiles.
- Toxicity from fertilizers and pesticides in the fiber stage of natural textiles.
- Depletion of renewable resources such as fossil fuels, energy use, and associated greenhouse gas emissions in the fiber production stage of synthetic fibers.
- Release of nutrients that caused eutrophication.
- Land use impacts.

- Human toxicity and eco-toxicity, hazardous waste substances management, and effluent treatment during the production stage and with the employment of chemicals, dyes, and finishes in the manufacturing link.
    - Cost of sustainable production.
    - Fast fashion cycles.
    - Consumer behavior.
    - Social criteria include working conditions, child labor, poor wages, safety, etc.
    - Environmental, health and safety issues.
    - Textile waste management coupled with landfill shortage.
    - Non-degradable textile materials.
    - Economic issues in the entire supply chain and also in the trade.

8 Sustainable Practices in the Workplaces

1. Save energy by turning off lights when not in use. You can utilize motion-detecting sensors to turn lights on when needed, provide signage for employees to turn off lights when not in use, or have timed lights for office hours.
2. If the business provides promotional materials or swag to vendors and employees, opt for recyclable tote bags or stainless-steel tumblers with reusable straws.

3. If your office is in a city, encourage public transportation or bikes for those that live nearby with secure places to place their bikes.
4. Encourage more paperless opportunities. Instead of printing off agendas for meetings, try the documents with all attendees through email.
5. Create volunteer opportunities for employees to **go green**. Various environmental causes need volunteers, including beach cleanups or restoration of local parks.
6. Contact a waste management vendor to create a recycling program for everyone at work.
7. Eliminate all **non-recyclable dishware** (including coffee cups) and install an **energy-efficient dishwasher**.
8. Provide eco-friendly snacks like apples, bananas, and oranges rather than plastic packaged bags of processed snacks.